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Fish Health News

A Service to the Field of Fish Health Research

VOL. II NO. 1, 2

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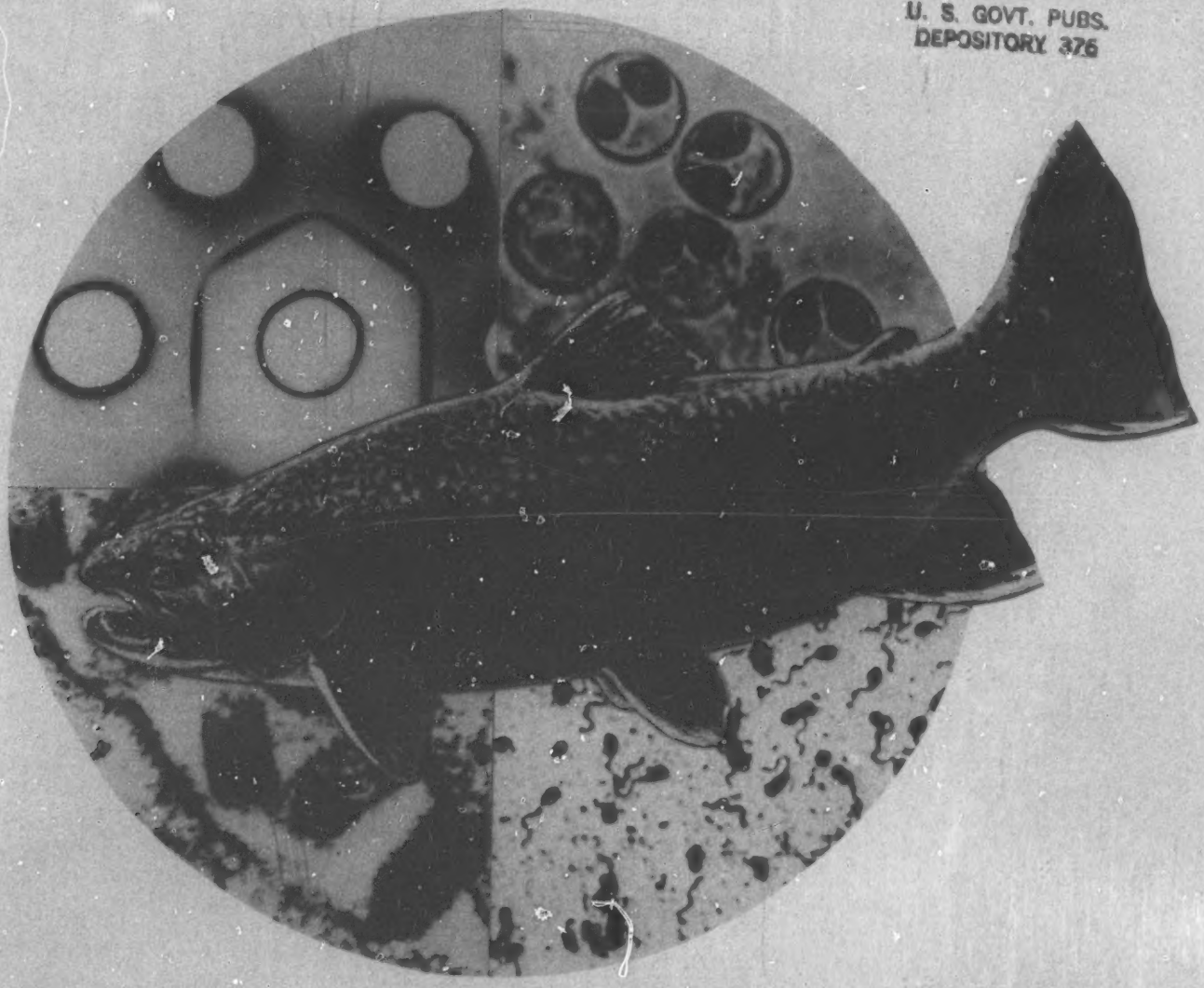

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FISH AND WILDLIFE SERVICE

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FISH HEALTH NEWS

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EDITORIAL

LITERATURE ALERT

The objective of *Fish Health News*--at least idealistically--is to include as completely and currently as possible the world's published literature on all aspects of fish health. We recognize that comprehensive coverage is a worthwhile goal; nevertheless, there are, we feel, important publications that are not included simply because they have not come into our hands.

We solicit our readers for reprints of works that have not been included in *Fish Health News*. Such reports need not be restricted to current publications--we will index and include reports that have appeared during the last 5 years. Of course all relevant publications add to the resource's value and to the machine searchable file.

REPORT

Edwardsiella ictaluri in the Green Knife Fish, *Eigemannia virescens*

Michael L. Kent and Joseph M. Lyons
Office of Animal Resources, M-014
University of California, San Diego
La Jolla, California 92093

The green knife fish (*Eigemannia virescens*) family: Sternopygidae is a common aquarium species from South American fresh waters and is used for neurophysiological research at Scripps Institution of Oceanography, La Jolla, California. Two disease outbreaks occurred in these fish maintained at Scripps in December 1981 and March 1982 with approximately 50 fish dying of an apparent acute bacteremia. Histopathology revealed dermal necrosis in the head and necrosis of kidneys with associated gram-negative bacteria. A gram-negative rod was isolated from head lesions and in pure culture from kidneys of all fish examined. Presumptively, that implicates the bacterium as the etiologic agent of the disease. A single kidney isolate from each outbreak was investigated further.

The bacterium had biochemical, morphological, and growth characteristics identical to *Edwardsiella ictaluri* as described by Hawke, et al. (1981. Int. J. Syst. Bact. 31[4]:396-400). Both knife fish isolates were serologically identical using rabbit antisera prepared in this laboratory, and were nonreactive with *E. tarda* and *Yersinia ruckeri* antisera. W. A. Rodgers, Auburn Univ., confirmed the biochemical and morphological similarities of this strain to *E. ictaluri* but found no serological cross-reactivity with the only recognized serotype of the species. This pathogen, which causes acute septicemia, was reported in 1976 and has only been isolated from ictalurid catfish (Hawke, J.P. 1979. J. Fish. Res. Board Can. 36[12]:1508-1512). Other freshwater species were refractive to the disease when challenged with catfish isolates as reported by Rodgers and Plumb (1982. Midwest Fish Dis. Conf., Kansas City, 13-14 July). Based on its unique host and serological characteristics, the green knife fish isolate represents a new strain of *E. ictaluri*.

Bacterial pathogens of aquarium fishes are seldom investigated to the extent as those of food fishes. When bacterial diseases of nonfood fishes are studied in greater detail it may be found that many fish pathogens reported to be host specific are more ubiquitous. This first report of *E. ictaluri* in South American fish, that were probably not exposed to ictalurid catfish, suggests a wide geographical distribution and serological diversity of the pathogen. Further studies on this strain are warranted, i.e., reinfection of green knife fish, infection studies to determine virulence to channel catfish, and more complete serological and DNA homology studies to elucidate its taxonomic status.

BOOK REVIEW

Olah, J., K. Molnar, and Z. Jeney, editors. 1981. Fish, pathogens and environment in European polyculture. Proceedings of an international seminar organized by Fisheries Research Institute, Szarvas, Hungary. Kellas Press, Budapest, Hungary. 527 pp.

The 43 scientific papers in this softback edition were presented at a major symposium held in Szarvas, Hungary 23-27 June 1981.

The first of five sections is on viral diseases affecting European fish culture and begins with an overview by W. Ahne. E. Osadchaya gives a general report on rhabdoviruses found in the Ukraine. N. Fijan et al. reported on a rhabdovirus from sheatfish, L. Bekesi et al. on a herpesvirus from sheatfish, and N. Fijan on vaccination of fish.

Reports on bacterial diseases are introduced by V. Prosyanaya in an overview. G. Csaba et al. reported on carp erythrodermatitis and septicemia, J. Farkas and J. Olah reported on pasteurella and streptococcus in fish, and K. Schreckenback on the use of polyvalent vaccines.

Parasites of fishes is a section beginning with an overview by J. Lom and I. Dykova. K. Molnar reported oocyst rejection of fish coccidia, G. Hoffman on *Mitraspora cyprini* and *Parvicapsula* sp., O. Bauer on dermocystidium, G. Jeney and K. Molnar on thelohanellosis, and M. Bucsek and G. Csaba on ultrastructural observations of a blood parasite of carp. R. Zitnan reported on helminthoses, F. Weirowski on *Bothriocephalus acheliognathi*, N. Snoj and J. Ocvirk on *Cystidicola farionis*, Z. Lucky on invasive diseases, Y. Strelkov et al. on diseases encountered in pen-rearing, and E. Shestakovskaya on acipenserid diseases.

Environmental effect and physiological response articles are by J. Plumb on water quality and infectious disease on catfish, N. Yunchis on Myxosporean infections, G. Jeney et al. on influences on environment on transaminase activity, N. Boyadziev on enzyme diagnostics of trout, J. Nemcsok et al. on blood chemistries, E. Malik and J. Olah on water quality and feeding to ammonia levels, and E. Kovacs-Gayer and M. Pusztai on ammonia content of fish blood. Z. Svobodova et al. reported on aflatoxin and mercury contamination in feeds, I. Matskasi on protease and alpha amylase activity in infected fish, D. Anderson and O. Dixon on fish disease serodiagnostics, A. Vichman on lysozyme and hemagglutinins in organs and J. Sovenyi and I. Petri on hemagglutinins in fish to human blood groups.

Gill necrosis syndrome of common carp was introduced by V. Musselius. L. Bekesi et al. related the syndrome to the environment, whereas I. Shchelkunov indicated a viral etiology. J. Farkas and J. Olah reported on a myxobacterial gill disease, E. Kovacs-Gayer discussed the histopathology of the syndrome, and M. Studnicka and A. Siwicki showed that lindane is toxic to gills and livers.

Articles are either in English (26) or Russian (17) with abstracts in both languages. The book gives an excellent view into fish disease diagnostics and research of Eastern European countries. The perspective is sometimes refreshingly innovative and unusual for Western scientists. While the book lacks an index and conference discussions, it is well edited. J. Olah, K. Molnar, and Z. Jeney, internationally recognized scientists, have presented a significant publication.

-- Douglas P. Anderson

NEWS ITEMS

DEDICATION OF JOURNAL

Volume 27(6) 1981 *Wiadomosci Parazytologiczne* (Parasitological Information) edited by Z. Jara, is dedicated to Prof. Dr. E. Grabda and his late wife, Dr. J. Grabda. Prof. Grabda is the retired Director of the Institute of Ichthyology in Szczecin, Poland.

His wife was a leading parasitologist of marine fishes and author of *Outline of Parasitology of Marine Fishes* published in 1981.

The issue consists of nine contributed papers on fish parasitology, and eight have been briefly annotated by Dr. S. F. Snieszko.

*****

EIGHTH ANNUAL EASTERN FISH HEALTH WORKSHOP

The Eighth Annual Eastern Fish Health Workshop will be co-sponsored by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service.

The meeting will be held 21-23 June 1983 at the National Fish Health Research Laboratory, Kearneysville, West Virginia.

All reservations must be made before 1 June. Further information can be obtained from:

Dr. Rocco C. Cipriano
U.S. Fish and Wildlife Service
National Fish Health Research Laboratory
Box 700
Kearneysville, West Virginia 25430

phone (304) 725-8462.

*****

FIRST INTERNATIONAL CONFERENCE
European Association of Fish Pathologists
Plymouth, England
19-23 September 1983

The first day of a provisional program, September 20, consists of invited papers constituting a symposium entitled, *Current Developments in Fish Pathology*. On the second day offered papers will be presented on bacterial and viral diseases, a poster session will be held and a round table discussion convened on effects of pollution on fish and shellfish. On the third day, papers on parasitic diseases, general pathology, invertebrate pathology, pathogenesis, and host defenses will be presented.

For further information contact: Dr. Colin Munn, Plymouth Polytechnic, Plymouth, England PL4 8AA.

SYMPOSIUM

Paddlefish (Polyodon spathula)--
A Threatened Resource?

Sponsored by the North Central Division of the American Fisheries Society, 6 December 1983 in conjunction with the 45th Midwest Fish and Wildlife Conference, Sheraton-St. Louis Hotel, St. Louis, Missouri.

For more information contact:

Joe G. Dillard
Missouri Department of Conservation
1110 College Avenue
Columbia, Missouri 65201.

LIBRARY ACCESSIONS

000001

Adamczyk, L. H.

1981. Parasitic fauna of the carp (*Cyprinus carpio*) fry bred in ponds fed with rainfall water. (Parazytofauna Narybku Karpia (*Cyprinus carpio*) Wyhodowanego W Stawach Zasilanych Woda Opadowa.) Wiad. Parazytol. 27(6):763-772. (Zaklad Zool. Hydrobiol. Inst. Biol. Podstaw Produkcji Zwierzecej AR, Lublin, Poland.).

In November and December 1976, 40 specimens of carp fry were examined in a pond at an experimental station near Lublin, Poland. The presence of *Dactylogyrus extensus* and *Khawia sinensis* was observed. These can be dangerous to fry. In this case unfavorable environmental conditions contributed to the cause. (S. F. Snieszko). (Paper in Polish).

002105.

000002

Agius, C.

1982. Virus diseases of warm water fish. Pages 115-130 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Inst. Aquacult. Univ Stirling, Stirling, Scotland.).

A review of the more important literature on eight agents (CCV, SVCV, IPNV, GSV, BGV, *Herpesvirus scopthalmi*, EVA-EVEX, and bluegill virus). Special emphasis is placed on these viruses and their potential for serious losses in tropical and subtropical fish farms where stocking densities are increased. (Ken Wolf).

002079.

000003

Agius, C., Mangunwiryo, H., Johnson, R. H., Smail, D. A.

1982. A more sensitive technique for isolating infectious pancreatic necrosis virus from asymptomatic carrier rainbow trout, *Salmo gairdneri* Richardson. J. Fish Dis. 5(4):285-292. (Inst. Aquacult. Univ. Stirling, Stirling FK9 4LA, Scotland.).

An improved technique for isolating infectious pancreatic necrosis virus (IPNV) is described. It involves trypsinization of the suspect tissue, separation of the trypsinized cells and their co-cultivation with indicator RTG-2 cells. This co-cultivation method is compared with homogenization, followed by membrane filtration, a procedure routinely employed by most disease diagnostic laboratories. From the two IPN-infected farms studied, IPNV could be isolated by homogenization from only 50 and 66%, respectively, of the fish from which virus was dectecte by co-cultivation. This difference in sensitivity can be explained in two ways, viz: (a) some of the virus is being retained by the membrane filter during filtration to remove contaminants following homogenization; (b) the presence of neutralizing factors in the tissue homogenate are neutralizing the virus and thus no cytopathic effect ensues. No correlation between serum neutralizing antibody levels and the differences in sensitivity of the two methods was found. The co-cultivation method is as practical as, and certainly no more time-consuming than, the homogenization technique. (Authors).

001967.

000004

Agrawal, R. K., Agrawal, S. M.

1981. Life history of *Haplorchoides vacha* sp. nov. (Trematode Heterophyidae) from the intestine of *Eutropiichthys vacha* (Ham). Riv. Parasitol. 42(1):185-190. (Dep. Biosci. Ravishankar Univ. Raipur 492 002 MP, India.).

Haplorchoides vacha sp. nov. from *Eutropiichthys vacha* is described and illustrated. The life cycle confirms the heterophyid pattern. (Authors).

002028.

000005

Ahne, W.

1981. European reference strains for fish virology. Bull. Eur. Assoc. Fish Pathol. 1(1):10-12. (Inst. Zool. Hydrobiol. Univ. Munich, Kaulbachstrasse 37, D-8000 Munchen 22, Fed. Rep. Germany.).

The author lists in tabular form the properties of four reference strains of virus: IPNV, PFR, SVCV, and VHSV. (Ken Wolf).

001986.

000006

Ahne, W.

1982. Isolation of infectious pancreatic necrosis virus from zebra danio, *Brachydanio rerio*. Bull. Eur. Assoc. Fish Pathol. 2(1):8. (Inst. Zool. Hydrobiol. Univ. Munich, Kaulbachstrasse 37, D 8000 Munchen 22, Fed. Rep. Germany.).

Serologically identified infectious pancreatic necrosis virus (most closely related to Sp strain) was isolated from a healthy appearing specimen fish. (Ken Wolf).

002023.

000007

Ahne, W.

1982. Comparative studies on the stability of four fish-pathogenic viruses (VHSV, PFR, SVCV, IPNV). (Vergleichende Untersuchungen uber die Stabilitat von vier fischpathogenen Viren (VHSV, PFR, SVCV, IPNV).) Zentralbl. Veterinaermed. Reihe B 29:457-476. (Inst. Zool. Hydrobiol. Univ. Munchen, Kaulbachstrasse 37, D-8000 Munchen 22, Fed. Rep. Germany.).

The effects of environmental conditions (water, mud, drying), the action of gamma and UV irradiation as well as the influence of chemical components and disinfectants on the infectivity of VHSV, PFR, SVCV, and IPNV were tested. (Author).

Results are given in tabular form and in an English summary of length greater than can be accommodated in *Fish Health News*. (Ken Wolf). (Paper in German).

002094.

000008

Ahne, W.

1982. Studies on the stability of fish viruses. (Untersuchungen zur Tenazitat der Fischviren.) Fortschr. Veterinaermed 35:305-309. (Inst. Zool. Hydrobiol. Univ. Munchen, Kaulbachstrasse 37, D-8000 Munchen, Fed. Rep. Germany.).

Persistense of VHSV, PFR, SVCV, and IPNV was studied in tap water at 4°C, in pond mud at 4°C, during drying at 4° and 20°C, under gamma irradiation, and under various disinfectants. Tabular data are given, but some differences are noted between data in this report and results given in a similar paper (Ahne, 1982, Zentralbl. Veterinaermed. Reihe B 29:457-476). (Ken Wolf). (Paper in German).

002095.

000009

Ahne, W., Mahnel, H., Steinhagen, P.

1982. Isolation of pike fry rhabdovirus from tench, *Tinca tinca* L. and white bream, *Blicca bjoerkna* (L.). J. Fish Dis. 5(6):535-537. (Inst. Zool. Hydrobiol. Univ. Munchen, 8 Munchen 22, Kaulbachstrasse 37, Fed. Rep. Germany.).

Virus was isolated from a hemorrhagic tench and from a bream with internal evidence of a hemorrhagic disease. The agents had rhabdovirus morphology, were neutralized by anti-PFR serum but were not pathogenic for small rainbow trout, tench, grass carp or pike held at 12-13°C. (Ken Wolf).

002155.

000010

Alderman, D. J.

1982. Fungal disease of aquatic animals. Pages 189-242 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth, Dorset, England.).

A scholarly and comprehensive review of fungi afflicting fishes, crustaceans, and molluscs. The author presents material in a taxonomically based sequence and includes fungi of uncertain affinity. He discusses briefly topics of isolation and culture pathogenicity and control. One-hundred eighty ref-

erences are cited. Fourteen plates of illustrations. (Ken Wolf).

002083.

000011

Alvarez-Pellitero, M. P., Pereira-Bueno, J. M., Gonzalez-Lanza, M. C.

1982. On the presence of *Chloromyxum truttae* Leger, 1906 in *Salmo trutta fario* from Leon (Duero Basin, NW Spain). Bull. Eur. Assoc. Fish Pathol. 2(1):4-7. (Lab. Parasitol. Fac. Vet. Estacion Agricola Exp. (CSIC), Ap 788, Leon, Spain.).

An illustrated report of the parasite found in two trout. (Ken Wolf).

002024.

000012

Alvarez-Pellitero, M. P., Pereira-Bueno, J. M., Gonzalez-Lanza, M. C.

1982. On the occurrence of *Myxobolus tauricus* Miroshnichenko, 1979 in *Barbus barbus bocagei* from Leon (Duero Basin, NW Spain). Bull. Eur. Assoc. Fish Pathol. 2(1):1-3. (Lab. Parasitol. Fac. Vet. Estacion Agricola Exp. (CSIC), Ap 788, Leon, Spain.).

Case report of occurrence in a cyprinid. (Ken Wolf).

002025.

000013

Amend, D. F., Conte, F. S.

1982. Disinfection: necessary preventive maintenance for healthy fish. Aquaculture 9(1):25-29. (Dep. Med. Sch. Vet. Med. Univ. California, Davis, Calif. 95616.).

Six major points of hatchery sanitation and hygiene are presented and discussed. Written for hatchery operators and their personnel and all others who are concerned with protecting and maintaining the health of captive or confined fishes. (Ken Wolf).

002054.

000014

Amin, O. M.

1974. Intestinal helminths of the white sucker *Catostomus commersoni* (Lacepede), in SE Wisconsin. Helminthol. Soc. Wash. 41(1):81-88. (Science Div. Univ. of Wisconsin-Parkside, Kenosha, Wisc. 53140.).

Five species of helminths (trematodes, cestodes, nematodes, and acanthocephalans) were recovered from the intestine of the white sucker, *Catostomus commersoni* (Lacepede) in southeastern Wisconsin. Distribution, structural observations, and host-parasite relationships are discussed. (Authors).

001994.

000015

Amin, O. M.

1982. Two larval trematodes (Strigeoidea) of fishes in southeastern Wisconsin. Proc. Helminthol. Soc. Wash. 49(2):207-213. (Sci. Div. Univ. Wisconsin-Parkside, Box 2000, Kenosha, Wis. 53141.).

Metacercariae of *Posthodiplostomum minimum* and metacercariae morphologically identical to *Ornithodiplostomum ptychocheilus* were recovered from 12 and 11 fish species (mostly centrarchids). (Author).

002090.

000016

Amin, O. M.

1982. Description of larval *Acanthocephalus parksidei* Amin, 1975 (Acanthocephala: Echinorhynchidae) from its isopod intermediate host. Proc. Helminthol. Soc. Wash. 49(2):235-245. (Sci. Div. Univ. Wisconsin-Parkside, Box 2000, Kenosha, Wis. 53141.).

Stages of larval *Acanthocephalus parksidei* Amin, 1975 were identified and sequentially traced from natural infections in the isopod intermediate host, *Caecidotea militaris*. This is the first account of larval development for any species of genus *Acanthocephalus* from North America. (Author).

002092.

000017

Amin, O. M.

1982. Adult trematodes (Digenea) from lake fishes of southeastern Wisconsin, with a key to species of the genus *Crepidostomum* Braun, 1900 in North America. Proc. Helminthol. Soc. Wash. 49(2):196-206. (Univ. Wisconsin-Parkside, Box 2000, Kenosha, Wis. 53141.).

Eleven species in six families of digenetic trematodes are reported from eleven species of fish. Morphological variations for each trematode species are documented and host and seasonal distribution are also noted. (Author).

002093.

000018

Amin, O. M., Myer, D. G.

1982. *Paracreptotrematina limi* gen. et sp. nov. (Digenea: Allocreadiidae) from the mudminnow, *Umbra limi*. Proc. Helminthol. Soc. Wash. 49(2):185-188. (Univ. Wisconsin-Parkside, Box 2000, Kenosha, Wis. 53141.).

Paracreptotrematina limi gen. et sp. nov. is described from the intestine of the mudminnow, *Umbra limi*. (Authors).

002091.

000019

Anderson, D. P., Merchant, B., Lizzio, E. F., Dixon, O. W.

1982. Flush contact immunization of rainbow trout with DNP hapten conjugated to various carriers. In Vitro 18(3):313. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

Rainbow trout *Salmo gairdneri* were immunized by flush contact or by intraperitoneal injection with single doses of the following dinitrophenyl (DNP) conjugates: DNP-keyhole limpet hemocyanin (KLH), DNP-ficoll, DNP-O-antigen (extracted from the fish pathogen *Yersinia ruckeri*), DNP-sheep red blood cells, or DNP-duck red blood cells. The immune response was followed by the passive hemolytic plaque assay to show splenic antibody-producing cells (APC), and passive hemagglutination to demonstrate humoral antibody titers. Seventeen days after immunization, high numbers of APC had developed against the hapten in all trout that had been immunized with any of the conjugates by flush contact or by injection. In cases where both the immune response to the hapten and carrier could be monitored, the numbers of APC were higher for the hapten than for the carrier. (Authors).

001987.

000020

Andrews, C.

1981. Latent infections with *Aeromonas salmonicida*. Bull. Eur. Assoc. Fish Pathol. 1:25. (Yorkshire Water Authority, Olympia House, Gelderd Road, Leeds LS12 6DD, Yorkshire, England.).

Presumed carrier brown trout were stocked in a stream with resident browns. Electrofishing 2 and 6 months later showed no latent infections in either stocked or resident fish. (Ken Wolf).

002118.

000021

Andrews, C.

1981. The occurrence of *Philometra ovata* in the British Isles. Bull. Eur. Assoc. Fish Pathol. 1:28. (Yorkshire Water Authority, Olympia House, Gelderd Road, Leeds LS12 6DD, Yorkshire, England.).

A case report note. (Ken Wolf).

002120.

000022

Andrews, C.

1981. The occurrence of a trichodinid protozoan as an internal parasite of fish in the U.K. Bull. Eur. Assoc. Fish Pathol. 1(1):17. (Yorkshire Water Authority, Olympia House, Gelderd Road, Leeds LS12 6DD, Yorkshire, England.).

A note. The ciliates were found in ureters and urinary bladder of cyprinids. (Fish urine is understandably very dilute.) (Ken Wolf).

002144.

000023

Andrews, C., Bucke, D.

1982. Epidermal hyperplasia in a coarse fish population. Bull. Eur. Assoc. Fish Pathol. 2:29-31. (Yorkshire Water Authority (Sci. Serv.), Olympia House, Gelderd Lane, Gelderd Road, Leeds LS12 6DD, Yorkshire, England.).

Roach were found to exhibit abnormalities the most pronounced of which was epidermal hyperplasia similar to fish pox.

The results from this investigation suggest that gross symptoms of this epidermal disease were most prevalent in older fish and they did not appear to markedly affect the growth rate of the fish. (Authors).

002115.

000024

Axelrod, H. R.

1983. Your fishes' health: mouth fungus. Tropical Fish Hobbyist 31(5):52-53, 57, 60-61. (T.F.H. Publ. Inc. 211 W. Sylvania Ave. Neptune City, N. J. 07753.).

A popular account for the tropical fish hobbyist. The life cycle is illustrated and treatment methods described. (Ken Wolf).

002070.

000025

Banner, C. R., Rohovec, J. S., Fryer, J. L.

1982. A rapid method for labeling rabbit immunoglobulin with fluorescein for use in detection of fish pathogens. Bull. Eur. Assoc. Fish Pathol. 2:35-37. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331-3804.).

This report describes a method for lebeling purified rabbit IgG and is derived in part from a procedure developed by Rinderknecht (1962) for labeling serum proteins. The procedure provides a more rapid, economical, and reliable means than that currently used for producing fluorescein-labeled antibody directed against fish pathogens. The method has been used to produce high quality diagnostic reagent suitable for identification of three bacterial pathogens, *Renibacterium salmoninarum*, *Edwardsiella tarda*, and *Vibrio anguillarum*, the protozoan parasite, *Ceratomyxa shasta*, and infectious pancreatic necrosis virus. (Authors).

001991.

000026

Banner, C. R., Rohovec, J. S., Fryer, J. L.

1982. A rapid method for labeling rabbit immunoglobulin with flourescein for use in detection of fish pathogens. Bull. Eur. Assoc. Fish Pathol. 2:35-37. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331-3804.).

The report describes in detail a method of labeling purified rabbit IgG using in part the procedure of Rinderknecht. Antisera included IPNV, *Ceratomyxa shasta*, *R. salmoninarum*, *E. tarda* and *V. anguillarum*. (Ken Wolf).

002113.

000027

Barash, H., Poston, H. A., Rumsey, G. L.

1982. Differentiation of soluble proteins in cataracts caused by deficiencies of methionine, riboflavin or zinc in diets fed to Atlantic salmon, *Salmo salar*, rainbow trout, *Salmo gairdneri*, and lake trout *Salvelinus namaycush*. Cornell Vet. 72(4):361-371. (Tunison, Lab. Fish Nutr. U.S. Fish Wildl. Serv. Cortland, N. Y. 13045.).

The protein pattern of cataractous lenses differed from that of normal lenses. Each cataract caused by the different dietary deficiences had a specific pattern of soluble lens proteins. Even though the general patterns of the soluble lens proteins for all three salmonids studied were similar, a specific pattern was unique for each of the species. (Authors).

002088.

000028

Baroni, A., Galesso, R., Bovo, G.

1982. Ultrastructural observations on the virus of viral hemorrhagic septicemia in culture. J. Fish Dis. 5(5):439-444. (Istituto di Igiene, Universita di Padova, Via Loredan, 18-3500 Padova, Italy.).

The report describes and illustrates morphogenesis and ultrastructure of the rhabdovirus of viral hemorrhagic septicemia in RTG-2 cells at 15°C. The findings confirm previous reports on morphology and ultrastructure. (Ken Wolf).

001973.

000029

Baroni, A., Galesso, R., Bovo, G.

1982. Ultrastructural observations on the virus of viral hemorrhagic septicemia in culture. J. Fish Dis. 5(5):439-444. (Istituto di Igiene, Univ. Padova, Via Loredan, 18-3500 Padova, Italy.).

The report describes and illustrates morphogenesis of the virus cultured in RTG-2 cells at 15°C. Fluorescent antibody technique showed viral antigen beginning at 8 h post-inoculation. The study confirms previous reports on morphology and ultrastructure. (Ken Wolf).

001998.

000030

Baum, E. T., Sawyer, E. S., Strout, R. G.

1982. Survival of hatchery-reared Atlantic salmon smolts vaccinated with a *Vibrio anguillarum* bacterin. N. Am. J. Fish. Manage. 2(4):409-411. (Maine Atlantic Sea-Run Salmon Comm. P. O. Box 1298, Bangor, Maine 04401.).

Atlantic salmon (*Salmo salar*) smolts were vaccinated with a single intraperitoneal injection of a trivalent *Vibrio* bacterin to evaluate the feasibility of increasing survival. Mortalities of the treated and untreated groups for the 4-5 week post-injection period at the hatchery were negligible. There was no significant difference in the rate of adult return of the vaccinated smolts compared to the controls, indicating that immunization did not enhance marine survival. (Authors).

002071.

000031

Beverly-Burton, M., Early, G.

1982. *Deretrema philippinensis* n. sp. (Digenea: Zoogonidae) from *Anomalops katoptron* (Beryciformes: Anomalopidae) from the Philippines. Can. J. Zool. 60(10):2403-2408. (Dep. Zool. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. Canada NIG 2W1.).

Deretrema philippinensis n. sp. is proposed for zoogonid Digenea found in pairs in the gallbladder of 10 of 12 flashlight fish (*Anomalops katoptron* Bleeker) from the Philippines. (Authors).

002162.

000032

Black, G. A.

1982. Gills as an attachment site for *Salmincola edwardsii* (Copepoda: Lernaeopodidae). J. Parasitol. 68(6):1172-1173. (Dep. Zool. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.).

A note describing changes in numbers and apparent change in attachment site of the copepod on *Salvelinus fontinalis* as a feature of increasing host length. (Ken Wolf).

002072.

000033

Bosse, M. P., Post, G.

1983. Tribrissen and tiamulin for control of enteric redmouth disease. J. Fish Dis. 6(1):27-32. (Dep. Fish. Wildl. Biol. Colorado State Univ. Fort Collins, Colo. 80523.).

Fifteen drugs were tested for in vitro control of *Yersinia ruckeri*. Those drugs yielding in vitro control were subsequently tested for in vivo control of induced enteric redmouth disease in rainbow trout. Two of the drugs, Tribrissen and tiamulin, controlled *Y. ruckeri* in vivo under laboratory conditions. The effective doses used in this study were 1.0 mg of Tribrissen per kg fish per day and 5.0 mg of tiamulin per kg fish per day, when the compounds were administered orally for 14 days. No toxic effects were noted at these dose levels, or from Tribrissen given at 15 times the above effective dose. (Authors).

002010.

000034

Brassard, P., Curtis, M. A., Rau, M. E.

1982. Seasonality of *Diplostomum spathaceum* (Trematoda: Strigeidae) transmission to brook

trout (*Salvelinus fontinalis*) in northern Quebec, Canada. Can. J. Zool. 60(10):2258-2263. (Inst. Parasitol. McGill Univ. Macdonald Coll. Campus, 21 111 Lakeshore Road, Ste. Anne de Bellevue, P.Q. Canada H9X 1CO.).

The availability of cercariae of *Diplostomum spathaceum*, calculated as the product of the rate of cercarial release, the expected cercarial life span, and the prevalence of infection in snail host *Lymnaea arctica*, was determined between June and September at a pond near Schefferville in the Quebec subarctic. Cercariae were present from late June until mid-September but were most abundant in July and August with a peak in early August. Cercarial availability coincided with the pattern of acquisition of metacercariae by sentinel fish (*Salvelinus fontinalis*). (Authors).

002163.

000035

Bruno, D. W., Munro, A. L. S.

1982. Detection of the causative agent of bacterial kidney disease. Bull. Eur. Assoc. Fish Pathol. 2(1):11-12. (DAFS Mar. Lab. Victoria Road, Aberdeen, Scotland.).

Lillies Allochrome enables small numbers of kidney disease (KD) bacterial cells to be detected and also differentiates collagen, fibrin, amyloid, and muscle reticulin. The technique demonstrates the presence of KD bacterial cells with equal and often better clarity than a well prepared Gram stain. (Authors).

002022.

000036

Bullock, A. M., Robertson, D. A.

1982. A note on the occurrence of *Ichtyobodo necator* (Henneguy, 1883) in a wild population of juvenile plaice, *Pleuronectes platessa* L. J. Fish Dis. 5(6):531-533. (Dunstaffnage Mar. Res. Lab. P. O. Box 3, Oban, Argyll PA34 4AD, Scotland.).

Case report of an unusual occurrence of costiasis in a marine species. As many as 30% of any trawled sampling were found– usually with light, but in some few, with heavy infestations. (Ken Wolf).

002154.

000037

Bullock, G. L., Maestrone, G., Starliper, C., Schill, B.

1983. Potentiated sulfonamide therapy of enteric redmouth disease. Can. J. Fish. Aquat. Sci. 40(1):101-102. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

Effective control of enteric redmouth disease was obtained during artificial infection of rainbow trout (*Salmo gairdneri*) and in natural outbreaks in rainbow trout and chinook salmon (*Oncorhynchus tshawytscha*) with a potentiated sulfonamide, Ro5-0037, a combination of five parts sulfadimethoxine and one part ormetoprim. Treatment was given at the rate of 50 mg per kg of fish for 5 d. (Authors).

002073.

000038

Burreson, E. M., Zwerner, D. E.

1982. The role of host biology, vector biology, and temperature in the distribution of *Trypanoplasma bullocki* infections in the lower Chesapeake Bay. J. Parasitol. 68(2):306-313. (Virginia Inst. Mar. Sci. Sch. Mar. Sci. Coll. William Mary, Glouchester Point, Va. 23062.).

This paper describes the biology of the leech *C. vivida*, the distribution of hosts and seasonality of *T. bullocki* in the lower Chesapeake Bay, and reports results of experiments to assess the role of temperature in seasonality and intensity of *T. bullocki* infections. (Authors).

001993.

000039

Bursey, C. R.

1982. *Eustrongylides tubifex* (Nitzsch) encystment in an American eel *Anguilla rostrata* (Le Sueur). J. Fish Biol. 21(4):443-447. (Dep Biol. Pennsylvania State Univ. Shenango Valley Campus, Sharon, Pa. 16146.).

A diseased American eel, *Anguilla rostrata* (Le Sueur), was captured during a survey. Two skin lesions were present. One was caused by the dermal encystment of a nematode, *Eustrongylides*

tubifex, the other was of undetermined origin. (Author).

002056.

000040

Bylund, G.

1972. Pathogenic effects of a diphyllobothriid plerocercoid on its host fishes. Commentat. Biol. Soc. Sci. Fenn. 58:3-11. (Parasitol. Inst. Soc. Sci. Fenn. Porthansgatan 3, SF-20500 Abo 50, Finland.).

Observations on the pathogenic effects of plerocercoids of *Diphyllobothrium dendriticum* on their host fishes are summarized. The harmful effect of this parasite is apparently inversely related to the resistance of the host and the ability of the host to inactivate the plerocercoids through encystment. Whitefish (*Coregonus lavaretus*) has a well developed defense mechanism, but in vendace (*Coregonus albula*) resistance mechanisms are poor or lacking and encysted plerocercoids have never been found; as the harmful effect is not neutralized by encapsulation of the plerocercoids, even a mild infection with one or a few plerocercoids may prove fatal. (Authors).

001997.

000041

Bylund, G., Fagerholm, H. P., Calenius, G., Wikgren, B. J., Wikstrom, M.

1980. Parasites of fish in Finland. II. Methods for studying parasite fauna in fish. Acta Acad. Abo. Ser. B Math. Phys. Mat. Naturvetensk. Tak. 40(2): 1-23. (Parasitol. Inst. Soc. Sci. Fenn. Porthansgatan 3, SF-20500 Abo 50, Finland.).

A review is given of methods employed for examining the parasite fauna of fish and for preparation of parasite specimens. Some of the methods are fairly standard, others are developed and modified according to the experiences by the authors. Special attention is given to parasite groups sparcely treated in standard works on parasitological techniques (ectoparasitic protozoans, monogeneans, etc.). A review is given on symptoms accompanying parasite disease of fish. (Authors).

001996.

000042

Calenius, G.

1980. Parasites of fish in Finland. V. Observations on protozoans of the genera, (*Trichophrya*, *Chilodonella*) and (*Ichthyophyhirius*). Acta Acad. Abo. Ser. B Math. Phys. Mat. Naturvetensk. Tek. 40(5):1-8. (Inst. Parasitol. Abo Akad. SF-20500 Abo 50, Finland.).

The occurrence of the ectoparasitic protozoa *Trichophrya piscium*, *Chilodonella cyprini* and *Ichthyophthirius multifiliis* on wild and cultivated fish was studied. (Authors).

001995.

000043

Calenius, G.

1980. Parasites of fish in Finland. III. Ciliates of the family Urceolariidae Dujardin, 1851. Acta Acad. Abo. Ser. B Math. Phys. Mat. Naturvetensk. Tek. 40(3): 1-16. (Inst. Parasitol. Abo Akad. SF-20500 Abo 50, Finland.).

In the course of an investigation of parasites on fishes in Finland attention was paid also to the urceolariid ciliates parasitizing the surface and gills of fishes. The fish material examined represents 27 fish species from brackish and freshwater localities. The urceolariid ciliates found both on brackish and freshwater fishes represent the genera *Trichodina* and *Trichodinella*, whereas *Tripartiella* was found only on freshwater hosts and *Paratrichodina* on fish from brackish water. (Author).

002037.

000044

Calenius, G., Bylund, G.

1980. Parasites of fish in Finland. IV. Ciliates of the genus *Apiosoma*. Acta Acad. Abo. Ser. B Math. Phys. Mat. Naturvetensk. Tek. 40(4): 1-12. (Inst. Parasitol. Abo Akad. SF-20500 Abo 50, Finland.).

During a study of fish parasites in Finland attention was also paid to ciliates of the genus *Apiosoma* (Fam. Schyphidiidae, Kahl 1935). The material contained 27 common fish species in Finland from freshand brackish-water localities and from fish farms.

The seasonal occurrence of these parasites seems to be adapted to a cycle with peaks in the spring and autumn months. (Authors).

002038.

000045

Campbell, A. C., Buswell, J. A.

1982. An investigation into the bacterial etiology of black patch necrosis in Dover sole, *Solea solea* L. J. Fish Dis. 5(6):495-508. (Dep. Biol. Paisley Coll. Technol, Paisley, Renfrewshire, Scotland.).

Samples of diseased and healthy Dover sole tissue were examined microbiologically and a long thin filamentous Gram-negative organism, strongly resembling *Flexibacter columnaris*, was repeatedly isolated from diseased tissue but was not found in healthy tissue. This organism was pathogenic to Dover sole, producing 100% mortality in 96 h at 17.5°C (±2°C) and the organism was reisolated from all the infected fish. It is proposed that a *Flexibacter columnaris*-like organism is associated with the condition in farmed Dover sole known as black patch necrosis. (Authors).

002151.

000046

Cann, D. C., Taylor, L. Y.

1982. An outbreak of botulism in rainbow trout, *Salmo gairdneri* Richardson, farmed in Britain. J. Fish Dis. 5(5):393-399. (Torry Res. Stn. 135 Abbey Road, Aberdeen AB9 8DG, Scotland.).

An outbreak of disease in a British trout farm was identified as fish botulism. The diagnosis was established by demonstration of toxin in the serum and intestinal contents of fish, and was confirmed by the production of experimental botulism in trout inoculated with toxin from a strain of *Clostridium botulinum* type E isolated from intestinal contents of a sick fish. The outbreak was controlled and eliminated within 1 month by conservative measures which comprised the emptying, cleaning and heavy liming of affected ponds; intensive examination of all ponds for immediate removal of dead and sick fish and, on public health grounds, the banning of movement of fish from the farm. This episode, although of considerable financial consequence to the farmer, was shown to have no public health significance. (Authors).

001979.

000047

Cann, D. C., Taylor, L. Y.

1982. An outbreak of botulism in rainbow trout, *Salmo gairdneri* Richardson, farmed in Britain. J. Fish Dis. 5(5):393-399. (Torry Res. Stn. 135 Abbey Road, Aberdeen AB9 8DG, Scotland.).

The diagnosis was established by demonstration of toxin in the serum and intestinal contents of fish, and was confirmed by the production of experimental botulism in trout inoculated with toxin from a strain of *Clostridium botulinum* type E isolated from intestinal contents of a sick fish. The outbreak was controlled and eliminated within 1 month by conservative measures that comprised emptying, cleaning, and heavy liming of affected ponds; intensive examination of all ponds for immediate removal of dead and sick fish and, on public health grounds, the banning of movement of fish outwith the farm. This episode, although of considerable financial consequence to the farmer, was shown to have no public health significance. (Authors).

002004.

000048

Caspi, R. R., Rozenszajn, L. A., Gothelf, Y., Pergamenikov-Litvak, T. Avtalion, R. R.

1982. The cells involved in the immune response of fish: II. PHA-induced clonal proliferation of carp lymphocytes in soft agar culture. Dev. Comp. Immunol. 6(4):683-692. (Dep. Life Sci. Bar-Ilan Univ. Ramat-Gan 52 100, Israel.).

The numbers of surface colonies and agar colonies were comparable. Preferential formation of surface over agar colonies was noted, and there wan an initial concentration of cells (individual for each fish) which resulted in optimal colony growth. This method was found to be suitable for isolating highly homogeneous subpopulations of PHA-responsive lymphocytes, which could subsequently be further expanded in liquid culture. A requirement for an exogenously produced growth factor (possibly similar to mammalian Interleukin

2) in the maintenance of long-term clonal cultures is suggested. (Authors).

002069.

000049

Chandran, A., Nair, N. B.

1980. Morphology of the copepodid stage of three marine lernaeopodids (Crustacea: Copepoda) from the south-west coast of India. Proc. Indian Acad. Sci. (Anim. Sci.) 89(2):155-163. (Dep. Aquat. Biol. Fish. Univ. Kerala, Trivandrum 695 007, India.).

Full illustrated descriptions are presented of the copepodid stage of *Pseudocharopinus narcinae* (Pillai), *Isobranchia appendiculata* Heegaard and *Brachiella trichiuri* Gnanamuthu. (Authors).

002127.

000050

Chandran, A., Nair, N. B.

1979. Structure of the bulla of three marine lernaeopodids (Crustacea: Copepoda). Aquat. Biol. 4:1-7. (Dep. Aquat. Biol. Fish. Univ. Kerala, Trivandrum 695007, India.).

Fully illustrated descriptions of the morphology and histology of the bulla of *Pseudocharopinus narcinae* (Pillai), *Isobranchia appendiculata* Heegaard and *Brachiella trichiuri* Gnanamuthu are presented. (Authors).

002128.

000051

Chen, C. R. L., Chung, H. Y., Kuo, G. H.

1982. Studies on the pathogenicity of *Flexibacter columnaris*–I. Effect of dissolved oxygen and ammonia on the pathogenicity of *Flexibacter columnaris* to eel (*Anguilla japonica*). Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:57-61. (Dep. Zool, Coll. Sci. Natl. Taiwan Univ. Taipei, Taiwan, Rep. China.).

Mortality rates of eels bathed in *Flexibacter columnaris* suspension for 1 h were studied in three different holding conditions: stagnant, aerated, and running waters. Dissolved oxygen, ammonia, and pH were determined daily during 9 days of the experiment. The least mortality rate was observed in running water condition, the highest in stagnant water, and aerated water in between. It appeared that the 24-h mortality rate correlated inversely with the dissolved oxygen. At adequate dissolved oxygen, the total mortality rate increased with the elevation of the ammonia level. (Authors). (Paper in Chinese).

002050.

000052

Chen, J. H., Chen, S. N., Kou, G. H.

1982. Primary monolayer culture of common carp (*Cyprinus carpio*) fin and its susceptibility to fish viruses. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:98-100. (Dep. Zool. Natl. Taiwan Univ. Taipei Taiwan, Rep. China.).

Epithelial-like cells were cultured and third passage cultures were assayed for ability to replicate the viruses of infectious pancreatic necrosis and those of eel origin: EVE, EVEX, and EVA. The new cell line of carp fin showed no CPE whereas the RTG-2 and EO-2 (eel ovary) showed CPE. (Ken Wolf).

002051.

000053

Chen, S. N., Kou, G. H.

1982. Immunodiffusion and immunoelectrophoresis studies of cell lines derived from Japanese eel (*Anguilla japonica*) ovary and kidney. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:1-7. (Dep Zool. Natl. Taiwan Univ. Taipei, Taiwan, Rep. China.).

The application of immunodiffusion and immunoelectrophoresis for distinguishing four fish cell lines was evaluated in the present study. The results showed that eel cell lines derived from kidney and ovary tissues revealed cross-reactive precipitin lines with either heterogeneous or homogeneous cell lines. But, the number of precipitin lines resolved in the immunoelectrophoresis plates could be used as criteria for the identification of eel cell lines at a family level.

By using immunodiffusion and immunoelectrophoresis techniques common cross-reactive antigens between eel cell lines and homogeneous tis-

sues were consistently observed, but they were absent in the heterogeneous systems. (Authors).

002042.

000054

Chevaliar, R., Gerard, J. P., Michel, C.

1981. Distribution and tissular kinetics of flumequin in the salmon trout (*Salmo gairdneri*, Richardson). Reseach of residues. (Distribution et Cinetique Tissulaire de la Flumequine Chez La Truite Arc-en-ciel (*Salmo gairdneri*, Richardson). Recherche de Residus.) Rev. Med. Vet. (Toulouse) 132(12):831-837. (Lab. Riker, avenue du 11-Novembre, Z.I. F-45300 Pithviers, France.).

Tissue-level concentrations of flumequine were measured at different times, after the treatment of rainbow trout at 6 or 12 mg/kg fish per day for 5 days. A microbiologic assay was used for research of the drug in muscle, liver, gills, and gut, and a spectrofluorimetric assay was used for the muscle. The highest level-concentrations were observed in gut and liver. Bacteriocidal doses were detected in muscle for 6 to 24 h, but the drug disappeared after 48 to 72 h in muscle. (Authors). (Paper in French).

002135.

000055

Chi, S. C., Chen, S. N., Kou, G. H.

1982. Monolayer culture of goldfish (*Carassius auratus*) swimming bladder. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:96-97. (Dep. Zool. Natl. Taiwan Univ. Taipei, Taiwan, Rep. China.).

Explant type primary cultures were initiated from swim bladder tissues and subsequently subcultured with trypsin to the sixth passage. Growth was slower than that of the EK-1 (eel kidney), FHM, and RTG-2 cell li. ●p. (Ken Wolf).

002049.

000056

Chien, C. H.

1982. An epithelioma in a cultured eel (*Anguilla japonica*). Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:88-91. (Lukang Branch Stn. Taiwan Fish. Res. Inst. Lukang, Rep. China.).

This communication is to report a histopathological study on an epithelial tumor found by the left eye of a cultured eel, *Anguilla japonica*, collected at Lu-Kang, Taiwan.

This tumor was due to hyperplasia of the epidermis. Mitotic figures were not uncommon. The neoplastic mass was multi-layered. Involution and folding of the epithelial layer give swirling and nodular appearance within the tissue. Most of the nodules were vacuolated in their center and some of them filled with mucous secretion as well as cell debris. Legends of figures are in English. (Author). (Paper in Chinese).

002047.

000057

Chien, C. H., Chien, C. Y.

1982. A visceral mycosis of Japanese eel. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:92-95. (Lu-Kang Branch, Taiwan Fish. Res. Inst. Lukang, Rep. China.).

A serious mycotic granulomatous inflammation was reported in a cultured eel (*Anguilla japonica*). The fungus invaded eventually from digestive tract to other visceral organs of the victim. PAS positive, nonseptate hypha and spores were identified in the granulomatous tissue of visceral organs. Legends of figures are in English. (Authors). (Paper in Chinese).

002048.

000058

Chien, C. H., Yu, T. C.

1982. Peduncular papillo-epithelioma of goldfish. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:84-87. (Lukang Branch Stn. Taiwan Fish. Res. Inst. Lu-kang, Hai-pu Li No. 106, Rep. China.).

Two goldfish (*Carassius auratus* Nilson) with spontaneous tumors on their naris were found at Lu-Kang in September 1980. A neoplastic growth on the operculum was observed 19 days after the removal of the original tumor. In both cases, there were papillomatous periphery and nest-shaped as well as arborescent central cores. The stroma was encapsuled by the basal membrane. Enclosed inside the membrane were closely arranged hyperchromatic columnar epithelial cells, loosely or-

ganized fusiform cells, blood vessels, mucous cells, fibrous material and deformed scales. Legends of figures are in English. (Authors). (Paper in Chinese).

002046.

000059

Christensen, N. O.

1981. The use of fish diseases in marine pollution effects monitoring programs. With a survey of a preliminary study in the Little Belt. Bull. Eur. Assoc. Fish Pathol. 1(1):7-9. (Den Kgl. Vet.- Og Landbohojskole, Ambulatorisk Klink, Bulowsvej 13 1870 Kobenhavn V. Copenhagen V, Denmark.).

A discussion, accompanied by color illustrations of skin ulcers, fin erosions, and lymphocystis, which might have use in monitoring pollution. (Ken Wolf).

001985.

000060

Cipriano, R. C.

1982. Immunogenic potential of growth products extracted from cultures of *Aeromonas salmonicida* for brook trout (*Salvelinus fontinalis*). Can. J. Fish. Aquat. Sci. 39(11):1512-1518. (U. S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

Growth products from virulent (3.93 and 3.101), an avirulent (3.10), and an atypical strain (3.111) of *Aeromonas salmonicida* yielded four protein containing fractions (designated fractions 1, 2, 3, 4) following chromatography on DEAE Sephadex A-25 of crude material that was precipitated from broth culture supernatants with $(NH_4)_2SO_4$ and ethanol. Vaccination trials, in which each of the four fractions from a virulent and an avirulent strain were injected intraperitoneally at a dose of 5 μg protein into brook trout (*Salvelinus fontinalis*) indicated that only fraction 4 consistently protected trout from experimental challenges. Immunizing fish with fraction 4 that was emulsified in Freund's incomplete adjuvant also protected trout from challenge but did not enhance protection. Additional brook trout that were immunized by injection with fraction 4 derived from either of two virulent, an avirulent, or an atypical strain of *A. salmonicida* were also protected from contact challenge with a different challenge strain. Fraction 4 was partially characterized as a glycoprotein. (Author).

002164.

000061

Cipriano, R. C.

1983. Resistance of salmonids to *Aeromonas salmonicida*: relation between agglutins and neutralizing activities. Trans. Am. Fish. Soc. 112(1):95-99. (Natl. Fish Health Res. Lab. U. S. Fish Wildl. Serv. Box 700, Kearneysville, W. Va. 25430.).

Serum of furunculosis-resistant rainbow trout *Salmo gairdneri*, when injected into brook trout *Salvelinus fontinalis*, increased resistance of the brook trout to virulent challenges of *Aeromonas salmonicida*, the furunculosis pathogen. Serum from susceptible Atlantic salmon *Salmo salar* did not confer passive resistance on brook trout although natural agglutinin titers in Atlantic salmon serum were equal to those in rainbow trout. Further analyses indicated that rainbow trout serum neutralized toxic components produced by *A. salmonicida*, but that Atlantic salmon serum did not. When 11 strains of rainbow trout were challenged with 10^8 virulent cells of *A. salmonicida*, a range of mortality from 0 to 83% resulted. Although no correlation was observed between the natural serum agglutin level of a particular strain and its relative resistance to experimental pathogen challenge, an inverse relation was apparent between cytotoxic serum-neutralization activity and resistance to furunculosis. (Author).

002165.

000062

Cipriano, R. C., Starliper, C. E.

1982. Immersion and injection vaccination of salmonids against furunculosis with an avirulent strain of *Aeromonas salmonicida*. Prog. Fish-Cult. 44(4):167-169. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

Replicate groups of brook trout (*Salvelinus fontinalis*) immunized by intraperitoneal injection of graded dilutions of an avirulent strain of *Aeromonas salmonicida* were protected from a virulent challenge. Mean mortality after challenge was 88% in control trout, 66% in trout immunized with 3×10^6 or 3×10^5 cells, and 39% in trout

immunized with 3 X 10^4 to 3 X 10^1 cells. In brook trout challenged after immersion for 60 s in a culture containing 2.3 X 10^9 avirulent cells of *A. salmonicida* per milliliter, mortality was 44%, compared with 94% in controls. In Atlantic salmon (*Salmo salar*), similarly vaccinated by immersion, mortality was 12.5% after challenge compared with 87.5% in controls. In additional studies, mean mortality of Atlantic salmon vaccinated by immersion was 14%, whereas that of control salmon was 92%. (Authors).

002058.

000063

Cone, D. K.

1982. A *Lactobacillus* sp. from diseased female rainbow trout, *Salmo gairdneri* Richardson, in Newfoundland, Canada. J. Fish Dis. 5(6):479-485. (Dep. Fish. Oceans, Res. Resour. Serv. St. John's, Newfoundland, Canada.).

The fish were found to have a mixed bacterial infection involving primarily a *Lactobacillus* sp. (a Gram-positive, chain-forming coccobacillus) and to a lesser degree Enterobacteriacea, *Aeromonas hydrophila* and *Pseudomonas fluorescens*. The bacteria were isolated from the visceral organs, kidney, and ascitic fluid present in the coelomic cavity. The fish had extensive degeneration and necrosis of the liver, spleen and kidney, and sloughing of intestinal epithelium. Other details are provided. (Author).

002149.

000064

Copland, J. W.

1982. *Myxobolus dermatobia* (Ishii, 1915) infection of wild eels, *Anguilla anguilla* L. in England. J. Fish Dis. 5(6):549-552. (Inst. Aquacul. Univ. Stirling, Scotland.).

This communication reports the presence of *M. dermatobia* in wild *A. anguilla* in England and describes the lesions and spores. (Author).

002158.

000065

Copland, J. W., Willoughby, L. G.

1982. The pathology of *Saprolegnia* infections of *Anguilla anguilla* L. elvers. J. Fish Dis. 5(5):421-428. (Reg. Vet. Lab. Dep. Agric. P. O. Box 388, Benalla, Victoria 3672, Australia.).

The main lesions observed were loss of epithelium leading to ulceration, oedema, and myofibrillar degenerative changes of the muscle mass. The oedema results in swelling of the inter-myotomal connective tissue, loss of nuclei and minor host reaction. Traumatic lesions with subsequent bacterial infections had a mononuclear inflammatory response. It is suggested that the rapid extension of the lesion is due to the loss of integrity of the integument and the widespread oedema, which altered the viability of tissues and assisted the *Saprolegnia* infection. The condition was fatal for infected elvers. (Authors).

002001.

000066

Dalsgaard, I.

1981. Spring ulcer disease in eels. Bull Eur. Assoc. Fish Pathol. 1(1):18-19. (Danish Inst. Fish. Mar. Res. Fish Dis. Lab. Royal Vet. Agric Univ. Bulowsvej 13, DK-1870 Copenhagen V, Denmark.).

Status report of studies of a skin disease complex of uncertain etiology–possibly bacterial. The condition is common (30-70%) at 4°C, but declines (0-2%) with warming temperature (16°C). (Ken Wolf).

002145.

000067

Danilkiewicz, Z.

1981. *Cystobranchus fasciatus* (Kollar) in the bug on the podlasie. (*Cystobranchus fasciatus* (Kollar) W Bugu Na Podlasiu.) Wiad. Parazytol. 27(6):773-774. (21-500 Biala Podlaska, Akademicka 2, Poland.).

The presence of the leach *Cystobranchus fasciatus* on the sheatfish (*Silurus glanis*) was described for the first time in Poland. (S. F. Snieszko). (Paper in Polish).

002104.

000068

Desser, S. S., Khan, R. A.

1982. Light and electron microscope observations on pathological changes in the gills of the marine fish *Lycodes lavalaei* Vladykov and Tremblay associated with the proliferation of an unidentified cell. J. Fish Dis. 5(5):351-364. (Dep. Zool. Ramsay Wright Lab. Univ. Toronto, Toronto, Ont. Canada M5 1A1.).

Pale and swollen gills were observed in 23 of 240 Laval's eelpouts, *Lycodes lavalaei* Vladykov and Tremblay (Perciformes), taken from several locations off the coasts of Newfoundland and southern Labrador. Light microscopic study of histolcgical sections revealed clusters of unidentified cells (X-cells) in the basal region of secondary gill lamellae and extending along the latter, between the epithelium and lamellar capillaries. The X-cells are compared with strikingly similar cells described from epidermal and pseudobranch tumors of marine fish. Although transformation of a host cell by virus or possibly pollution has been suggested, neither the nature nor the origin of the X-cells can be determined. (Authors).

001981.

000069

Desser, S. S., Khan, R. A.

1982. Light and electron microscope observations on pathological changes in the gills of the marine fish *Lycodes lavalaei* Vladykov and Tremblay associated with the proliferation of an unidentified cell. J. Fish Dis. 5(5):351-364. (Dep. Zool. Ramsay Wright Lab. Univ. Toronto, Toronto, Ont. Canada M5 1A1.).

Pale and swollen gills were observed in 23 of 240 Laval's eelpouts, *Lycodes lavalaei* Vladykov and Tremblay (Perciformes), taken from several locations off the coasts of Newfoundland and southern Labrador. Light microscopic study of histological sections revealed clusters of unidentified cells (X-cells) in the basal region of secondary gill lamellae and extending along the latter, between the epithelium and lamellar capillaries. In the electron microscope two types of X-cells were enclosed in a network of cytoplasmic processes from dense envelope cells. The X-cells are compared with strikingly similar cells described from epidermal and pseudobranch tumors of marine fish. Neither the nature nor the origin of X-cells could be determined. (Authors).

002006.

000070

Dixon, P. F., Hill, B. J.

1981. The enzyme-linked immunosorbent assay (ELISA) as a rapid means of detecting IPN virus in tissue cultures and diseased fish. Bull. Eur. Assoc. Fish Pathol. 1:34-36. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. The Nothe, Weymouth, Dorset DT4 8UB, England.).

Procedures for carrying out ELISA are described. Particularly good results were obtained when high titer anti-IPNV serum was used. Assays could be performed in 2 h and IPN victim fish served as satisfactory antigen. With several rhabdoviruses, detection of viral antigen was achieved most confidently when high titered (> 1: 50,000) serum was used. The authors state that a full report is to be published. (Ken Wolf).

002123.

000071

Do, T. T.

1982. *Paraergasilus longidigitus* Yin, 1954 (Copepoda, Poecilostomatoida) parasitic on Japanese freshwater fishes, with a key to Japanese Ergasilidae. Fish Pathol. 17(2):139-145. (Ocean Res. Inst. Univ. Tokyo, Nakano-ku, Tokyo 164, Japan.).

Paraergasilus longidigitus is recorded for the first time from Japan. It lives in the nasal cavities of four species of freshwater fishes. A key to eleven species of Ergasilidae occurring on Japanese freshwater fishes is also given. (Author).

002065.

000072

Dykova I., Lom J., Grupcheva G.

1983. *Eimeria branchiphila* sp. nov. sporulating in the gill filaments of roach, *Rutilus rutilus* L. J. Fish Dis. 6(1):13-18. (Inst. Parasitol. Czechoslovak Acad. Sci. Flemingovo nam. 2, 166 32 Praha 6, Czechoslovakia.).

Eimeria branchiphila sp. nov. is described from the roach, *Rutilus rutilus* L. collected in Bulgaria. Sporulated oocysts were found in gill secondary lamellae and less frequently were associated with melano-macrophage centers in the spleen and in kidney interstitial tissue. In the gills, parasite cells identified as zygotes and sporulation stages were

also encountered. This unusual site of sporulation represents a mechanism of sporocyst dispersal previously not recorded in fish coccidia. (Authors).

002009.

000073

Elarifi, A. E.

1982. The histopathology of larval anisakid nematode infections in the liver of whiting, *Merlangius merlangus* (L.), with some observations on blood leucocytes of the fish. J. Fish Dis. 5(5):411-419. (Mar. Lab. P. O. Box 101, Aberdeen AB9 8DB, Scotland.).

The cellular response of whiting, *Merlangius merlangus* (L.), to *Contracaecum* and *Anisakis* larvae parasitic in the liver was characterized by the presence of neutrophils, macrophages and proliferating fibroblasts. A capsule formed around the larvae after the removal of all necrotic debris by phagocytic cells. Melanin granules were deposited around the capsule. Four types of blood leucocytes were identified; thrombocytes, lymphocytes, monocytes and neutrophils. Phagocytic activity of the neutrophils and macrophages was suggested by the presence of dark stained bodies within them. (Authors).

001977.

000074

Elarifi, A. E.

1982. The histopathology of larval anisakid nematode infections in the liver of whiting, *Merlangius merlangus* (L.), with some observations on blood leucocytes of the fish. J. Fish Dis. 5(5):411-419. (Mar. Lab. P. O. Box 101, Aberdeen AB9 8DB, Scotland.).

The cellular response of whiting, *Merlangius merlangus* (L.), to *Contracaecum* and *Anisakis* larvae parasitic in the liver was characterized by the presence of neutrophils, macrophages, and proliferating fibroblasts. A capsule formed around the larvae after the removal of all necrotic debris by phagocytic cells. Melanin granules were deposited around the capsule. Four types of blood leucocytes were identified: thrombocytes, lymphocytes, monocytes, and neutrophils. Phagocytic acitivity of the neutrophils and macrophages was suggested by the presence of dark stained bodies within them. (Author).

002002.

000075

Ellis, A. E.

1982. Differences between the immune mechanisms of fish and higher vertebrates. Pages 1-29 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (DAFS Mar. Lab. Victoria Road, Aberdeen, Scotland.).

A review as the author states, 'restricted mainly to the immune mechanisms in teleosts and a comparison of them with higher vertebrates'. Subheadings are: stem cells, structure and function of kidneys, structure and function of the spleen, structure and function of the thymus, lymphocyte subpopulations–the question of T and B cells, immunoglobulins–structure and function, factors affecting the immune response, complement, phagocytic cells and inflammation, and hypersensitivity responses. (Ken Wolf).

002074.

000076

Ellis, A. E., Dear, G., Stewart, D. J.

1983. Histopathology of Sekiten-byo caused by *Pseudomonas anguilliseptica* in the European eel, *Anguilla anguilla* L. in Scotland. J. Fish Dis. 6(1):77-79. (Mar. Lab. P. O. Box 101, Victoria Road, Aberdeen AB9 8DB, Scotland.).

Histopathological changes of the disease in eight grossly affected specimens are described and illustrated. Major changes were found in skin and liver, lesser in kidneys, and none in other organs. (Ken Wolf).

002015.

000077

Ellis, A. E., McVicar, A. H., Munro, A. L. S.

1982. A preliminary report on the epidemiology of proliferative kidney disease in brown trout (*Salmo trutta*) and Atlantic salmon parr (*S. Salar*) in Scotland. Bull. Eur. Assoc. Fish Pathol. 2(1):13-15. (DAFS Mar. Lab. Victoria Road, Aberdeen, Scotland.).

First report of major outbreaks of proliferative kidney disease in Atlantic salmon. Incidences reached 60-90% of O salmon. Epizootiological observations are reported and findings discussed. (Ken Wolf).

002021.

000078

Ellis, A. E., Waddell, I. F., Minter, D. W.

1982. A new systemic fungal disease in *Salmo salar* parr. Bull. Eur. Assoc. Fish Pathol. 2(3):46-47. (DAFS Mar. Lab. Aberdeen, Scotland.).

Year-old parr (at 5-6°C) sustained mortalities that lasted through February, and black yeast of the genus *Phialophora* was isolated on Sabouraud's agar. The fungus was considered pathogenic because of its presence in various organs, especially in the swim bladder. *Pseudomonas fluorescens* was isolated on Difco furunculosis agar, but its role was not discussed. (S. F. Snieszko).

002139.

000079

Enzmann, P. J., Maier, B., Bigott, K.

1981. Biochemical data on the RNA of VHS-V and RVC indicating a possible serological relationship. Bull. Eur. Assoc. Fish Pathol. 1:37-39. (Fed. Res. Inst. Anim. Virus Dis. P. O. B. 1149, D-7400 Tubingen, Fed. Rep. Germany.).

Virion-RNAs of VHS-V and RVC were compared. Both RNA-species revealed the same molecular weight and sedimentation coefficient. After precipitation of viral polysomes from VHS-V and RVC infected cells with an antiserum against VHS-V, RNA could be isolated from both types of polysomes which had a molecular weight of about 3.5×10^6 daltons in electrophoresis or a sedimentation coefficient of about 36S. Since this is the longest RNA, other than the virion-RNA that is found in infected cells, it seems to be the mRNA of the L-protein. From these data a serological relationship between VHS-V and RVC is proposed. (Authors).

002124.

000080

Eversole, A. G., Field, D. W.

1982. Prophylactic treatment of elvers for *Trichodina* infestation. Prog. Fish-Cult. 44(3):142-143. (Dep. Entomol. Fish. Wildl. Clemson Univ. Clemson, S. C. 29631.).

Comparative tests were made of NaCl at 10,000 to 30,000 mg/L for 10 or 30 min and $KMnO_4$ at 5 to 1000 mg/L for 0.5 to 30 min. *Trichodina* were controlled more effectively with $KMnO_4$. Recommended treatment is 500 or 1,000 mg/L for 0.5 min. Short exposure at high concentration was more effective than long exposure at low concentration (5 to 50 mg/L for 30 to 10 min). (Ken Wolf).

001984.

000081

From, J., Horlyck, V.

1981. First recorded occurrence of *Proteocephalus percae* (Muller, 1780) in Danish farmed trout. Bull. Eur. Assoc. Fish Pathol. 1:40-41. (Danish Trout Cult. Res. Stn. Broens, DK-6780 Skaerbaek, Denmark.).

Case report of a dual infestation of cestode and nematode. Only nematodes responded to Flubenol therapy, (Ken Wolf).

002125.

000082

Fukuda, Y., Kusuda, R.

1982. Detection and characterization of precipitating antibody in the serum of immature yellowtail immunized with *Pasteurella piscicida* cells. Fish Pathol. 17(2):125-127. (Oita Pef. Fish. Exp. Stn. Kamiura, Minami-Amabe, Oita, Japan.).

Precipitating antibody against crude lipopolysaccharide (LPS) of *Pasteurella piscicida* in the serum of immature yellowtail, *Seriola quinqueradiata*, immunized with the cellular antigen was demonstrated by gel diffusion method. The serum from immunized yellowtail showed a precipitin line formation when the specific soluble antigen, LPS, was reacted against the fish serum after electrophoresis. The single line occurred in the μ-globulin region identified to yellowtail immunoglobulin. The precipitating antibody activity was detected in the high molecular weight fraction of gel filtration of Sepharose 6B. It is concluded that precipitating

antibody produced in the serum of immature yellowtail corresponds with macroglobulin in young fish. (Authors). (Paper in Japanese).

002064.

000083

Gorman, A. M., Moring, J. R.

1982. Occurrence of *Cryptocotyle lingua* (Creplin, 1825) (Digenea: Heterophyidae) in the rock gunnel, *Pholis gunnellus* (L.). Can. J. Zool. 60(10):2526-2528. (Migratory Fish Res. Inst. Dep. Zool. Univ. Maine, Orono, Maine 04469.).

Pholis gunnellus, is reported as a new natural second intermediate host of *Cryptocotyle lingua*. Mature flukes were recovered 5-20 days after feeding metacercariae teased from adult gunnels to laboratory-reared chicks; mice were refractory. The prevalence of infected *Littorina littorea* (11.1%) harboring pleurolophocercous cercariae was significantly greater than *L. obtusata* (0.9%) from the same site. (Authors).

002052.

000084

Guildal, J. A.

1982. On a case of worm-cataract in Danish eelpouts (*Zoarces viviparus* L.). Bull. Eur. Assoc. Fish Pathol. 2(1):16. (Inst. Vet. Microbiol. Hyg. Bulowsvej 13, DK-1870, Copenhagen V, Denmark.).

First case report of *Diplostomum* eye infestations of eel pouts in brackish waters adjacent to the Baltic. Thirty of 268 fish were parasitized. The probable epizootiology is discussed. (Ken Wolf).

002020.

000085

Haensly, W. E., Neff, J. M., Sharp, J. R., Morris, A. C., Bedgood, M. F., Boem, P. D.

1982. Histopathology of *Pleuronectes platessa* L. from Aber Wrac'h and Aber Benoit, Brittany, France: long-term effects of the *Amoco Cadiz* crude oil spill. J. Fish Dis. 5(5):365-391. (Dep. Vet. Anat. Coll. Vet. Med. Texas A&M Univ. College Station, Tex. 77843.).

The predominant lesions and conditions that characterized fish from the oiled estuaries were: fin and tail necrosis, hyperplasia and hypertrophy of gill lamellar mucous cells, gastric gland degeneration, decreased hepatocellular vacuolation (lipid), increased concentration of hepatic macrophage centers, and lateral trunk muscle fiber degeneration. Dilation of Bowman●s space, glomerular hypertrophy and abdominal muscle fiber degeneration were pronounced at the last sampling interval. Other types of lesions were seen at a lower frequency. (Authors).

001980.

000086

Haensly, W. E., Neff, J. M., Sharp, J. R., Morris, A. C., Bedgood, M. F., Boem, P. D.

1982. Histopathology of *Pleuronectes platessa* L. from Aber Wrac'h and Aber Benoit, Brittany, France: long-term effects of the *Amoco Cadiz* crude oil spill. J. Fish Dis. 5(5):365-391. (Dep. Vet. Anat. Coll. Vet. Med. Texas A&M Univ. College Station, Tex. 77843.).

Tissue samples were fixed, processed, and stained by routine histologic procedures for qualitative and quantitative histopathological examination. The predominant lesions and conditions that characterized fish from the oiled estuaries were: fin and tail necrosis, hyperplasia and hypertrophy of gill lamellar mucous cells, gastric gland degeneration, decreased hepatocellular vacuolation (lipid), increased concentration of hepatic macrophage centers, and lateral trunk muscle fiber degeneration. Dilation of Bowman's space, glomerular hypertrophy and abdominal muscle fiber degeneration were pronounced at the last sampling interval. Other types of lesions were seen at a lower frequency. Well illustrated. (Authors).

002005.

000087

Hagargi, S. S., Amoji, S. D.

1981. *Myxosoma karnatakae*, n. sp. (Protozoa: Myxosporidia) from the caudal muscles of fresh water teleost fish *Barbus chola* (Ham. et Buch.). Arch. Protistenk. 124:385-390. (Dep. Microbiol. Post-Graduate Cent. Gulbarga 585105, Karnataka State, India.).

Morphology, biology and taxonomic position of a new histozoic species of Myxosporidia (*Myxosoma*) inhabiting the caudal muscles of *Barbus chola* is

described. This is the first report of a Myxosporidia from *Barbus chola*. (Authors).

002109.

000088

Hahnel, G. B., Gould, R. W.

1982. Effects of temperature on biochemical reactions and drug resistance of virulent and avirulent *Aeromonas salmonicida*. J. Fish Dis. 5(4):329-337. (Natl. Fish. Res. Cent. U.S. Fish Wildl. Serv. Seattle, Wash. 98115.).

Incubation temperatures of 11, 18, and 28°C did not substantially affect biochemical reactions of either virulent or avirulent forms of *Aeromonas salmonicida* subspecies *salmonicida*. The only change observed, amygdalin fermentation, was positive at 11 and 18°C but negative at 28°C. Several isolates utilized sucrose, a characteristic not normally recognized for *A. salmonicida* subspecies *salmonicida*. Antimicrobial susceptibility screening indicated resistance to novobiocin increased at the higher incubation temperatures. Standardized drug sensitivity testing procedures and precise zone diameter interpretive standards for bacterial fish pathogens are needed. (Authors).

001971.

000089

Hahnel, G.B., Gould, R.W., Boatman, E.S.

1983. Serological comparison of selected isolates of *Aeromonas salmonicida* ssp. *salmonicida*. J. Fish. Dis. 6(1):1-11. (Natl. Fish. Res. Cent. Seattle, Washington 98115.).

Eight isolates of *Aeromonas salmonicida* ssp. *salmonicida* were collected during furunculosis epizootics in North America Pacific coast states and provinces. Both virulent and avirulent forms of each isolate, confirmed by challenge and electron microscopy, were examined. Serological comparisons by cross-absorption agglutination tests revealed no serological differences between isolates. Using the double diffusion precipitin test, a single band was observed when antigen from a sonicated virulent strain was reacted with antiserum against a sonicated, virulent strain absorbed with homologous, avirulent strain. The presence of the single band was eliminated by excess sonication. (Authors).

002008.

000090

Hastings, T. S., MacKenzie, K., Ellis, A. E.

1982. Presumptive mycobacteriosis in mackerel (*Scomber scombrus* L.). Bull. Eur. Assoc. Fish Pathol. 2:19-21. (Dep. Agric. Fish. Scotland, Mar. Lab. P. O. Box 101, Victoria Road, Aberdeen AB9 8DB, Scotland.).

Multiple nodules of three kinds, but all containing acid-fast bacteria, were found in the viscera, but most commonly in spleen and kidneys. Incidence was 80-100%. (Ken Wolf).

002108.

000091

Hawkins, W. E., Solangi, M. A., Overstreet, R. M.

1983. Ultrastructure of the macrogamont of *Eimeria funduli*, a coccidium parasitizing killifishes. J. Fish Dis. 6(1):33-43. (Gulf Coast Res. Lab. Box AG, Ocean Springs, Miss. 39564.).

The ultrastructure of the macrogamont of *Eimeria funduli* was studied in hepatocytes of the killifish *Fundulus grandis* and *F. similis*. Findings are described in detail and illustrated. (Authors).

002011.

000092

Hawkins, W. E., Solangi, M. A., Overstreet, R. M.

1983. Ultrastructure of the macrogamont and microgamete of *Eimeria funduli*, a coccidium parasitizing killifishes. J. Fish Dis. 6(1):45-57. (Gulf Coast Res. Lab. Box AG, Ocean Springs, Miss. 39564.).

The ultrastructure of the microgamont and micgrogamete of the coccidium *Eimeria funduli* was studied in hepatocytes of the killifish *Fundulus grandis* and *F. similis*. Findings are described in detail and illustrated. (Authors).

002012.

000093

Heckmann, R.

1982. Eye fluke, *Diplostomum spathaceum* of fishes from the Upper Salmon River Hatchery

site, Stanley, Idaho. Final Rep. Recommendations, Brigham Young Univ. Provo, Utah 84602. (Dep. Zool. Brigham Young Univ. Provo, Utah 84602.).

An 83 page xerographically reproduced report consisting of sections dealing with a review of known research, data from the subject study, a discussion of cumulative research results, a summary of recommendations and pertinent references. (Ken Wolf).

002032

000094

Hein, S., Shepard, J., Broussard, W.

1979. Occurrence of the parasitic copepod *Lernaeenicus radiatus* on the red drum (*Sciaenops ocellata*) and Gulf Menhaden (*Brevoortia patronus*) in Barataria Bay, Louisiana. La. Dep. Wildl. Fish. Mar. Res. Lab. Tech. Bull. 35:68. (Mar. Res. Lab. Grand Terre Island, La. 70358.).

Five of 92 red drum and 18 of 1,362 menhaden were parasitized. (Authors).

002055.

000095

Hernan Baeza, K., Raul Castro, R.

1980. Three new species of Caligidae in Chilean fauna. (Tres especies do Caligidae nuevas para la fauna chilena.) Mus. Nac. Hist. Nat. Not. Mens. (Santiago) 35(288,289):3-6. (Inst. Invest. Oceanologi. cas. Casilla 1240 Univ. Chile, Sedo Antofagasta, Chile.).

Caligus lalandei, *C. quadratus* and *Lepeophtheirus edwardsii* are recorded for the first time from Chile, all on host new to the species (*Seriola mazatlana* Steindachner; *Acanthistius pictus* Tschudi and *Paralichthys adspersus* Steindachner). Male of *C. lalandei* is described in detail and illustrated. (Authors). (Paper in Spanish).

002166.

000096

Hill, B. J.

1982. Infectious pancreatic necrosis virus and its virulence. Pages 91-114 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. The Nothe, Weymouth, Dorset, England.).

A review consisting of topics on host range, characteristics of the virus, characteristics of the disease, other diseases involving infectious pancreatic necrosis (IPN) or 'IPN-like' viruses, and factors affecting virulence. (Ken Wolf).

002078.

000097

Hilton, J. W., Ferguson, H. W.

1982. Effect of excess vitamin D_3 on calcium metabolism in rainbow trout *Salmo gairdneri* Richardson. J. Fish Biol. 21(4):373-379. (Dep. Nutr. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

Trout were reared for 24 weeks on diets containing 4000, 104,000 or 1,004,000 IU of supplemental vitamin D_3 kg^{-1} dry diet. No effect of excess vitamin D_3 was detected in the weight gain, feed efficiency or total mortalities of trout in the different groups. None of the fish showed any signs of hypercalcaemia and no significant difference was detected in the calcium, magnesium, phosphorus, and sodium content of the trout vertebrae or total carcass. However, there was a significant increase in the calcium, magnesium, and phosphorus content of the skin in trout reared on the highest supplemental level of vitamin D_3 (1,004,000 IU kg^{-1} diet). No overt signs of renal calcinosis were detected in any of the trout. (Authors).

002057.

000098

Hoffmann, R., Dangschat, H.

1981. A note on the occurrence of proliferative kidney disease in Germany. Bull. Eur. Assoc. Fish Pothol. 1:33. (Inst. Zool. Hydrobiol. Univ. Munich, Kaulbachstrasse 37, D-8000 Munchen 22, Fed. Rep. Germany.).

The years 1980 and 1981 saw an increase in outbreaks of proliferative kidney disease. A relationship with pollution is suggested. (Ken Wolf).

002122.

000099

Holloway, H. L. Jr., Smith, C. E.

1982. A myopathy in North Dakota walleye, *Stizostedion vitreum* (Mitchill). J. Fish Dis. 5(6):527-530. (Dep. Biol. Univ. North Dakota, Box 8238, Univ. Stn. Grand Forks, North Dakota 58202.).

The report describes the histopathologic findings and compares them with previously described myopathies. Grossly, the condition involved degeneration of the lateral trunk musculature, principally coagulation necrosis of muscle fibers with accompanying inflammatory response and formation of granulomas. Secondary lesions consisted of foci of acute myolysis. The findings are similar to those of myofibrogranuloma. (Ken Wolf).

002153.

000100

Horlyck, V.

1982. Unusual findings in *Ichthyophonus*. Bull. Eur. Assoc. Fish Pathol. 2(3):51. (Danish Trout Cult. Res. Stn. Brons, KD-6780 Skaerbaek, Denmark.).

The usual gross sign of *Ichthyophonus* disease in rainbow trout is the presence of systemic granulomatosis in the musculature, liver, spleen, and around the viscera. In the case described numerous small black spots were present in tissues surrounding the viscera, and some nonpigmented granulomas occurred in the liver and heart. (S. F. Snieszko).

002141.

000101

Horne, M. T.

1982. The rathogenicity of *Vibrio anguillarum* (Bergman). Pages 171-187 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Dep. Biol. Inst. Aquacult. Univ. Stirling, Stirling, Scotland.).

A brief review that includes description of the organism, occurrence of vibriosis, routes of entry into the host, and pathogenesis. (Ken Wolf).

002082.

000102

Horne, M. T., Tatner, M., McDerment, S., Agius, C., Ward, P.

1982. Vaccination of rainbow trout, *Salmo gairdneri* Richardson, at low temperatures and the long-term persistence of protection. J. Fish Dis. 5(4):343-345. (Dep. Biol. The Univ. Stirling FK9 4LA, Scotland.).

Rainbow trout (100-120 g) were vaccinated at 6°C with a formalized *Vibrio anguillarum* bacterin by i.p. injection, 30 min immersion, or perorally. Except for immersion, which used a 10-fold dilution of the vaccine, the fish received 3.5 mg of wet weight bacteria. Fish were challenged by i.p. 85 days later when temperature was 11°C. Protection was complete with the i.p. administration, 47% by immersion, and negligible orally. Fish immunized 11 months previously by i.p. showed 44% protection, and orally only 22%. (Ken Wolf).

001972.

000103

House, E. W., Benditt, E. P.

1981. The ultrastructure of spontaneous coronary arterial lesions in steelhead trout (*Salmo gairdneri*). Am. J. Pathol. 104(3):250-257. (Dep. Biol. Idaho State Univ. Pocatello, Idaho 83201.).

A case report of a study carried out on changes in spawning specimens. Well illustrated. (Ken Wolf).

002033.

000104

Ikeda, Y., Minami, T.

1982. Hematological and hemochemical assessment of streptococcal infection in cultured yellowtail. Bull. Jpn. Soc. Sci. Fish. 48(10):1383-1388. (Tokyo Univ. Fish. 5-7, Konan 4, Minato, Tokyo 108, Japan.).

The changes in various blood constituents were examined in both yellowtail *Seriola quinqueradiata* infected naturally and inoculated with *Streptococcus* sp. The fish weighing about 150 g were injected intraperitoneally with 10^7 cells of *Streptococcus* per fish. The water temperature was about 26°C.

The size of spleen, kidney, and heart (% of body weight) in naturally infected fish increased, but that of hepatopancreas did not. Increase in neutrophil count was recognized in both naturally infected and inoculated fish that the symptoms were noticeable, but increase in lymphocyte count was recognized in only the former. *Streptococcus* sp. infection was associated with increases in serum glucose level and Al-P activity, having a high correlation. Al-P activity was especially proportional to the degree of external symptoms. (Authors). (Paper in Japanese).

002067.

000105

Jara, Z.

1972. Tuberculosis of fishes and other poikilothermic vertebrates. Vet. Med. 28(12):705-710. (ul. Norwida 31, Wroclaw, Poland.).

A review paper with comments on the status of information on the disease in Poland. The review is very complete and is based on well-selected international literature. It includes taxonomy of mycobacteria, occurrence of the disease, mode of infection, gross and microscopic pathology, diagnosis, and control. There is also a brief description of mycobacteriosis in amphibia and reptilia. Mycobacteriosis resembles mammalian pulmonary tuberculosis.

In Poland there are no reports of tuberculosis in cultured food fishes. In the Institute of Fish Pathology in Warsaw, tuberculosis has been diagnosed in five species of ornamental fishes and in *Iguana iguana* in a zoo. (S. F. Snieszko). (Paper in Polish).

002097.

000106

Jara, Z., Szerow, D.

1981. Histopathological changes and localization of tapeworm *Khawia sinensis* Hsu, 1935 in the intestine of carps (*Cyprinus carpio* L.). (Zmiany Histopatologiczne I Lokalizacja Tasiemca *Khawia sinensis* W. Jelicie Karpi (*Cyprinus carpio* L.).) Wiad. Parazytol. 27(6):695-703. (Zaklad Fizjologii Zwierzat Inst. Zool. UWr, Wroclaw, Poland.).

Results of examination of 90 carp from one pond. The frequency of infestation was 73% in 2-year-old fish, and 50% in 3-year-olds. Included are results of histopathological examinations. Well illustrated. (S. F. Snieszko). (Paper in Polish).

002098.

000107

Jara, Z., Szerow, D.

1981. Electrophoretic examination of the serum of carps (*Cyprinus carpio* L.) infected with tapeworm *Caryophyllaeus* sp. (Badania Elektroforetyczne Surowicy Karpi (*Cyprinus carpio* L.) Zarazonych Tasiemcem *Caryophyllaeus* sp.) Wiad. Parazytol. 27(6):713-716. (Zaklad Fizjologii Zwierzat, Inst. Zool. UWr, Wroclaw, Poland.).

Invasion of the tapeworms resulted in lowering of the albumin contents of the serum that was followed by general hypoproteinemia. (S. F. Snieszko). (Paper in Polish).

002103.

000108

Jara, Z., Szerow, D., Niemczuk, W.

1981. The level of total protein and its fractions in the serum of carps (*Cyprinus carpio*) L. infected with tapeworm *Khawia sinensis* Hsu, 1935. (Poziom Bialka Calkowitego I Jego Frakcji W Surowicy Karpi (*Cyprinus carpio*) L. Zarazonych Tasiemcem *Khawia sinensis* Hsu, 1935.) Wiad. Parazytol. 27(6): 705-711. (Zaklad Fizjologii Zwierzat Inst. Zool. UWr, Wroclaw, Poland.).

In infested carp the total serum protein was reduced, but the percentage of different fractions was similar to that of noninfested fish. (S. F. Snieszko). (Paper in Polish).

002100.

000109

Jastrzebski, M.

1981. The occurrence of blood flagellates belonging to genus *Trypanosoma* Gruby, 1841, in the blood of carp - *Cyprinus carpio* L. and tench *Tinca tinca* L. (Wystepowanie Swidrowcow Z Rodzaju *Trypanosoma* Gruby, 1841 We Krwi Karpia – *Cyprinus carpio* L. I Lina – *Tinca tinca* L.) Wiad. Parazytol. 27(6):753-761. (Zaklad

Chorob Pasozytniczych, IChZil SGGW-AR, Warszawa, Poland.).

Trypanosoma danilewskyi was found in the blood of five of 67 carp, and in three of 27 tench examined. This is the first isolation of *T. danilewskyi* in Poland. Findings are presented in tables and photographs. (S. F. Snieszko). (Paper in Polish).

002106.

000110

Johansson, N., Svensson, K. M., Fridberg, G.

1982. Studies on the pathology of ulcerative dermal necrosis (UDN) in Swedish salmon, *Salmo salar* L. and sea trout, *Salmo trutta* L. populations. J. Fish Dis. 5(4):293-308. (Salmon Res. Inst. S-810 70 Alvkarleby, Sweden.).

Continuous visual observations of the signs of development of UDN in fish kept in aquaria were correlated with light microscopical, transmission and scanning electron microscopical results. The initial signs of the disease are circles of pathologically-changed epidermis. The tight junctions of the squamous cells within these mucus-free areas disintegrate resulting in the loss of the protective function of the zonula occludens. Subsequently, the intercellular spaces dilate and communicate with the exterior. Necrosis of the epidermal cells due to hydromineral disturbances occur simultaneously with fungal infections and marked responses of the melanophores. It is suggested that the fungal infections are triggered by metabolites of the necrotic epidermal cells. The epidermal cells are shed and the fungus determines the further course of the disease which terminates in large ulcers covered with fungal hyphae. No substantial evidence for the presence of a virus could be recorded at any stage of the disease. It is concluded that the disease is a squames and the fungus appears as an opportunist which causes the eventual death of the fish. (Authors).

001969.

000111

Jorgensen, P. E. V.

1982. Infectious pancreatic necrosis (IPN): disastrous disease or illusion . Bull. Eur. Assoc. Fish Pathol. 2(1):17. (State Vet. Serum Lab. Hangovej 2, DK-8200 Arhus N. Denmark.).

A 300-word objective overview of the significance of infectious pancreatic necrosis under various situations. (Ken Wolf).

002019.

000112

Jorgensen, P. E. V.

1981. Experimental VHS-vaccine in field trials. Bull. Eur. Assoc. Fish Pathol. 1(1):13-14. (State Vet. Serum Lab. Hangovej 2, DK-8200 Arhus N. Denmark.).

In lab tests, fish vaccinated with an attenuated F-1 strain showed residual virulence was present at 1-15% mortality. On challenge, however, mortality was only 20-30%, whereas mortality in non-vaccinated fish was 70-100%. Field tests showed comparable residual virulence. Results from challenge were not yet available. (Ken Wolf).

002142.

000113

Kano, T., Okauchi, T., Fukui, H.

1982. Studies on *Pleistophora* infection in eel, *Anguilla japonica*–II. preliminary tests for application of fumagillin. Fish Pathol. 17(2):107-114. (Takeda Chem. Ind. Ltd. Res. Dev. Dep. Anim. Health Prod. Div. Osaka, Japan.).

The rate of infection during the medication was controlled within the range of 0-15% when administered at 5 mg per kg B.W. per day for 60 days, 7.2 to 14.4 mg per kg B.W. per day for 30 days or 50 mg per kg B.W. per day for 20 days. Intermittent administration for a total of 20 days (5 days on, 5 days off) at 50 mg per kg B.W. per day was also effective. When administration was started 6 days or more post inoculation, the effect was insufficient.

The disease spread to healthy fish when raised with diseased eels and fumagillin was also found to be useful for prevention of the contagion.

Fumagillin had a significant effect on preventing the development of the parasite in the fish that had been held under low temperatures such as 13-14°C over 30 days after inoculation, if the drug was administered before the parasite began

to develop by temperature elevation. (Authors). (Paper in Japanese).

002061.

000114

Kimura, H., Kusuda, R.

1982. Studies on the pathogenesis of streptococcal infection in cultured yellowtails, *Seriola* spp. effect of crude exotoxin fractions from cell-free culture on experimental streptococcal infection. J. Fish Dis. 5(6):471-478. (Dep. Cult. Fish. Kochi, Univ. Japan.).

Exotoxins prepared from streptococcal bacteria of *Seriola* spp. origin were grown in fluid culture and fractionates of the supernatant used in toxicity studies in *Seriola* by oral and percutaneous exposure. Toxic fractions were then applied simultaneously with oral challenge with *Streptococcus* spp. bacteria. Two fractions E and G were shown to have a significant effect on the pathogenesis of infection. (Authors).

002148.

000115

Kimura, T., Yoshimizu, M., Tanaka, M.

1981. Studies on a new virus (OMV) from *Oncorhynchus masou*–II. Oncogenic nature. Fish Pathol. 15(3,4):149-153. (Fac. Fish. Hokkaido Univ. Hakodate, Japan.).

Survivors of experimental infection developed tumors. The perioral maxillary and mandibular region are the most frequent sites of tumor formation. In decreasing order of frequency, tumors were also found on the caudal fin, gill-cover, eye, and kidney. Histopathologically the tumors were composed of abundantly proliferative, well differentiated epithelial cells supported by fine connective tissue stroma.

Although virus particles were not observed in tumor cells, *Oncorhynchus masou* virus isolation was successful from a tumor tissue sample that appeared necrotic on day 275 postinfection and from primary cultures of a tumor tissue from another fish sampled 296 days postinfection. (Authors).

002035.

000116

Kimura, T., Yoshimizu, M., Tanaka, M., Sannohe, H.

1981. Studies on a new virus (OMV) from *Oncorhynchus masou*–I. Characteristics and pathogenicity. Fish Pathol. 15(3,4):143-147. (Fac. Fish. Hokkaido Univ. Hakodate, Japan.).

During 1978, we isolated a previously undescribed pathogenic virus from ovarian fluids of normal appearing adult landlocked masu salmon (*Oncorhynchus masou*). Characteristics of the newly recognized virus conform to those of the *Herpesvirus* group, and the agent is provisionally named *Oncorhynchus masou* virus (OMV). The OMV has proved to be lethal for chum salmon (*O. keta*) by artificial immersion infection. Marked histopathologic changes were observed in liver sections. These were multiple foci of severe necrosis and syncytia formation.

Further repeated experiments using other species of salmonids revealed that coho salmon (*O. kisutch*), kokanee salmon (*O. nerka*), and rainbow trout (*Salmo gairdneri*) were also susceptible. (Authors).

002036.

000117

Kohn, A., Fernandes, B. M. M.

1982. *Neoapocreadium chabaudi* sp. n. (Apocreadiidae) and *Schikhobalotrema acuta* (Linton, 1910) (Haplosplanchnidae) trematodes parasites of marine fishes in Brazil. Ann. Parasitol. (Paris) 57(2):121-126. (Dep. Helmintol. Inst. Oswaldo Cruz, C.P. 926, Rio de Janeiro, R. J. Brazil.).

Neoapocreadium chabaudi sp. n. (Digenea, Apocreadiidae is described from the intestine of a marine fish *Stephanolepis hispidus* from Brazil, and the genus *Schikhobalotrema* Skrjabin and Guschansekaja, 1955 represented by its type species *S. acuta* (Linton, 1910). Skrjabin and Guschanslaka, 1955 is for the first time reported from the intestine of *Strongylura marina* in Brazil. (Authors).

001988.

000118

Kohn, A., Macedo, B., Fernandes, B. M. M.

1982. About some trematodes parasites of *Haemulon sciurus* (Shaw, 1803). Mem. Inst. Oswaldo Cruz Rio de J. 77(2):153-157. (Inst. Oswaldo Cruz, Caixa Postal 926, 20000 Rio de Janeiro, Brazil.).

From September, 1980 to August, 1981 forty specimens of *Haemulon sciurus* were examined for parasites. Partial results concerning only the collected trematodes are reported. Figures, measurements and comments of each species are given. (Authors).

001989.

000119

Korting, W.

1982. Protozoan parasites associated with swim-bladder inflammation (SBI) in young carp. Bull. Eur. Assoc. Fish Pathol. 2:25-28. (Fish Dis. Res. Unit, Sch. Vet. Med. Bischofsholer Damm 15, D-3000 Hannover 1.).

Moderate SBI was found in two populations of 6-8-week-old carp. Viral and bacteriologic tests were negative, but multicellular aggregates were common in the pathologically altered swim bladder tissues. The author notes similarities of the aggregates to vegetative stages of myxosporida–possibly those of *Sphaerospora angulata*. (Ken Wolf).

002116.

000120

Kovaks-Gayer, E., Csaba, G., Bekesi, L., Bucsek, M., Szakolczai, J. Molnar, K.

1982. Studies on the protozoan etiology of swim bladder inflammation in common carp fry. Bull. Eur. Assoc. Fish Pathol. 2:22-24. (Cent. Vet. Inst. Budapest, Hungary, Tabornok u.2. 1581.).

Four to 6 week-old fry with acute disease showed no evidence of bacteria or virus; instead significant correlation was found with a protozoan postulated to be precursor stages of a myxozoan that could be *Sphaerospora angulata*. (Ken Wolf).

002107.

000121

Kusuda, R., Kimura, H.

1982. Characteristics of gliding bacterium isolated from cultured yellowtail *Seriola quinqueradiata*. Bull. Jpn. Soc. Sci. Fish. 48(8):1107-1112. (Fish. Dis. Lab. Fac. Agric. Kochi Univ. Nankoku, Kochi 783, Japan.).

Typical symptoms of the disease observed were as follows; erosion of the mouth, frizzle of the fins and rot of the tail. The isolate was gram negative, oxidase positive and catalase negative 0.2-0.4 × 2-6 μm rod with flexible movement. Resting stage was not observed in the fish tissue nor on the medium. Growth was observed on media with seawater but not on media with NaCl. Growth was observed at 37°degrees°C but not at pH 4. Production of indol, H_2S, gas, acetoin and pigment were negative. Ammonium production was positive. Nitrate reduction was negative. Gelatin liquefaction was positive. Hydrolysis of casein, chitin and starch were positive but hydrolysis of arginine and esculin were negative. Twenty-six carbohydrates were not utilized. Dissolution of hide powder and tryosin were positive but dissolution of xantine was negative. Lipase, urease and congo red tests were positive. From these results the isolated strain was classified into the genus *Cytophaga*. (Authors). (Paper in Japanese).

002161.

000122

Larsen, J. L., Mellergaard, S.

1981. Microbiological and hygienic problems in marine aquaculture: furunculosis and vibriosis in rainbow trout (*Salmo gairdneri*). Bull. Eur. Assoc. Fish Pathol. 1:29-32. (Inst. Hyg. Microbiol. Royal Vet. Agric. Univ. Bulowsvej 13, DK-1870 Copehagen V, Denmark.).

Furunculosis was the greater problem, and its presence was attributed to introduction of carriers. Generalized methods of prevention are briefly noted, and readers are advised that mariculture managers should increase bacteriologic surveillance when temperature or mortality increase. Therapy should start promptly and alternative drugs are to be considered. (Ken Wolf).

002121.

000123

Lawler, A. R.

1982. Deaths of aquarium-held fishes caused by monogenetic trematodes. II *Gyrodactylus* spp. on *Fundulus heteroclitus* (Linnaeus). Drum Croaker 20(2):15-17. (Gulf Coast Res. Lab. Ocean Springs, Miss. 39564.).

Case report of mortality attributed to monogenetic trematodes and successfully controlled with a continuous treatment of 1:16,000 formalin. (Ken Wolf).

002110.

000124

Lester, R. J. G.

1982. *Unicapsula seriolae* n. p. (Myxosporea, Multivalvulida) from Australian yellowtail kingfish *Seriola lalandi*. J. Protozool. 29(4):584-587. (Dep. Parasitol. Univ. Queensland, St. Lucia, Brisbane, Australia 4067.).

Unicapsula seriolae n. sp. forms long plasmodia within the striated muscle fibers of *Seriola lalandi* off eastern Australia. Its spores are composed of three valves, only one of which contains a developed polar capsule. Within the capsule, the filament makes 2 1/2 - 3 turns, and this criterion can be used to spearate *U. seriolae* from the two other members of the genus. The flesh or infected fish disintegrates during slow cooking. (Author).

002160.

000125

Li, M. F., Marryatt, V., Annand, C., Odense, P.

1982. Two newly established cell cultures from fish. In Vitro 18(3):295. (Fish. Environ. Sci. Dep. Fish. Oceans, Halifax Lab. Halifax, N.S. B3J 2S7, Canada.).

The SH-cells were obtained from a primary culture of sturgeon cardiac explants (*Acipenser oxyrhynchus*) and the GFT-cells were from a primary culture of guppy fetus explants (*Poecilia reticulata*). The SH-cells are fibroblast-like and the GFT-cells are epithelium-like. The shortest generation times observed were 68 h for SH-cells and 58 h for GFT-cells. LT-1 virus produced large plaques on monolayer culture of the SH-cells, but not on the GFT-cells. In contrast IPN virus caused serious cellular destruction on GFT-cells, but the destructive effect of IPNV on the SH-cells was minimal. Cytopathic changes of both cultures, however, were observed at a high magnification when they were infected by either LT-1 or IPN virus. (Authors).

002130.

000126

Lidgerding, B. C., Schill, W. B.

1982. Fish cell lines: characterization of six cell lines by enzyme profiles. In Vitro 18(3):295. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

The BB (brown bullhead), BF-2 (bluegill), FHM (fathead minnow), RTG-2 (rainbow trout), CHSE-214 (chinook salmon), and EPC (carp) cell lines were examined using horizontal starch gel electrophoresis for the presence of 20 enzymes. In all, profiles for 15 enzymes were developed. Comparison of the profiles for phosphoglucose isomerase (PGI), malate dehydrogenase (MDH), esterase (EST), and 6-phosphogl[illegible]nate (6PG) provided a clear-cut identification among the lines. The two salmonid lines (RTG-2, CHSE-214) could be distinguished by the banding position of either PGI or EST. The two cyprinid lines (FHM, EPC) were identified by the postion of the MDH or 6PG band. The BB and BF-2 lines had distinctive 6PG profiles. (Authors).

002129.

000127

Lin, C. L., Ting, Y. Y., Song, Y. L.

1982. Proceeding evaluation of HIVAX *Vibrio anguillarum* bacterin in the vaccination of milkfish (*Chanos chanos*) fingerlings. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:80-83. (Tainan Branch Stn. Taiwan Fish. Res. Inst. Tainan, Taiwan, Rep. China.).

The HIVAX *Vibrio anguillarum* bacterin in the vaccination of milkfish (*Chanos chanos*) fingerlings was evaluated again and results were summarized as follows: *V. anguillarum* bacterin was proven to be safe in the vaccination of milkfish fingerlings (body weight 0.3 g to 0.57 g), the immune response of fingerlings was onset 1 week after vaccination, the immunity of milkfish immunized with *V. anguillarum* bacterin was still solid after 5 months

at 12-38°C. Figures and tabular data in English. (Authors). (Paper in Chinese).

002045.

000128

Liu, C. K., Han, H., Wang, C. H.

1982. Histological study of eels (*Anguilla japonica*). Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:62-73. (Grad. Inst. Vet. Med. Natl. Taiwan Univ. Taipei, Taiwan, Rep. China.).

Economic importance of cultured eels has led to a need for the study of diseases of this species of fish.

Histology is a fundamental science for physiology, pharmacology, toxicology, and pathology. In order to adequately and accurately study diseases of eels, knowledge of the histology of the healthy eels become necessary. Based on this reason, 13 organs of Japanese eels (*Anguilla japonica*) were histologically studied. Fourteen figures are given and legends are in English. (Authors). (Paper in Chinese).

002043.

000129

Liu, K. C., Chien, C. H.

1982. Ultrastructure of the hyaline granules in the renal epithelial cell of cultured eel (*Anguilla japonica*) associated with branchionephritis. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:74-79. (Anat. Dep. Natl. Yang Ming Med. Coll. Taipei, Taiwan, Rep. China.).

The renal epithelial cells of cultured eels that showed symptoms of branchionephritis were studied with electron microscopy. The general structure of the epithelial cells was described with special emphasis on the single membrane bound electron dense granules that were corresponded to the hyaline granules observed under light microscopy. Two types of electron dense granules were revealed according to their internal structure. Type I granule had amorphous electron dense matrix within. Type II granule had a few to over a dozen membraneous whorls. These granules were comparable to deuterobodies and residual bodies morphologically. The releasing of those electron dense granules into tubules was associated with cellular degeneration and necrosis under severe pathological development. (Authors).

002044.

000130

Lo, C. F., Wang, C. H., Huber, F., Kou, G. H.

1982. The study of *Clinostomum complanatum* (Rudolphi, 1814). II. The life cycle of *Clinostomum complanatum*. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:26-56. (Dep. Biol. Fu-Jen Univ. Taipei 242, Taiwan, Rep. China.).

This paper describes the life cycle of *Clinostomum complanatum* and the characteristics of the worms in each stage. The effect of this parasite on experimentally infected fish is also discussed. Illustrated with 21 figures. Part two of a series. (Authors).

002040.

000131

Lommel, R., Reichenbach-Klinke, H. H.

1981. *Telotha* sp. as a gill parasite of discus fish. (*Telotha* sp. als Kiemenparasit bei Diskusfischen.) Kleintierpraxis 26:515-516. (Inst. Zool. Hydrobiol. Kaulbachstrasse 37, 8000 Munchen 22, Fed. Rep. Germany.).

The occurrence of isopods on gills of freshly imported discus fish is reported. The parasites have been determined as *Telotha* sp. (Authors). (Paper in German).

002039.

000132

Lozinska-Gabska, M.

1981. Biology and pathogenetic action of *Bothriocephalus gowkongensis* Yeh, 1955 and *Khawia sinensis* Hsu, 1935. (Bioologia I Dzialanie Patogenne *Bothriocephalus gowkongensis* Yeh, 1955 I *Khawia sinensis* Hsu, 1935.) Wiad. Parazytol. 27(6):685-694. (Zaklad Fizjologii Zwierzat Inst. Zool. UWr, Wroclaw, Poland.).

A review of the development cycles of the two cestodes and their spread in Europe. Included is the description of the effect of their presence in

carp and of control measures. (S. F. Snieszko). (Paper in Polish).

002099.

000133

Lozinska-Gabska, M.

1981. Activity of aspartate and alanine aminotransferse in the alimentary canal of carps (*Cyprinus carpio*) L. infected with tapeworms *Bothriocephalus gowkongenis* Yeh, 1955 or *Khawia sinensis* Hsu, 1935. (Aktywnosc Aminotransferazy Asparaginianowej I Alaninowej W Przewodzie Pokarmowym Karpi (*Cyprinus carpio*) L. Zarazonych Tasiemcami *Bothriocephalus gowkongensis* Yeh, 1955 Lub *Khawia sinensis* Hsu, 1935.) Wiad. Parazytol. 27(6):717-743. (Zaklad Fizjologii Zwierzat, Inst. Zool. UWr, Wroclaw, Poland.).

The activities of aspartate aminotransferase (AsAT) and alanine aminotransferase (AlAT) were determined in the liver, and interior and posterior intestine of carp during their first and second year of life. It is concluded that the decreased vitality and death of carp infested with the tapeworm is associated with winter environmental conditions and defective metabolism of proteins in the liver. (S. F. Snieszko). (Paper in Polish).

002102.

000134

Manning, M. J., Grace, M. F., Secombes, C. J.

1982. Developmental aspects of immunity and tolerance in fish. Pages 31-46 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Dep. Biol. Sci. Plymouth Polytech. Devon, England.).

In the authors' words the '. . review brings together some of this information on the functional development of the immune system in fish and discusses the outcome of immunization during the first few months of life'. Subsections deal with histogenesis of the lymphoid organs, humoral antibody responses, cell-mediated immunity, nonspecific defense mechanisms, and role of the thymus in the ontogenetic development of the immune system. (Ken Wolf).

002075.

000135

McCarthy, D. H., Johnson, K. A.

1982. A serotypic survey and cross-protection test of North American field isolates of *Yersinia ruckeri*. J. Fish Dis. 5(4):323-328. (Pitman-Moore Inc. P. O. Box 344, Titusville, Washington Crossing, N. J. 08560.).

A serological study of 23 North American strains of *Yersinia ruckeri* showed that they were comprised essentially of one serotype–the classical Hagerman serotype. Cross-protection tests showed that rainbow trout could be protected from challenge with various strains. Continuous surveillance of enteric redmouth disease and further work including DNA binding studies is necessary to determine the precise significance of the other related serotypes. (Authors).

001970.

000136

McVicar, A. H.

1982. *Ichthyophonus* infections of fish. Pages 243-269 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Mar. Lab. Aberdeen, Scotland.).

A major review that places emphasis on areas of discrepancy in earlier literature, and on more recent data concerned with identification, distribution, life cycle, effects on the host, and economic significance of the disease. Eighteen figures are included. (Ken Wolf).

002084.

000137

Meier, W.

1981. Viral hemorrhagic septicemia in non-salmonid fishes. Bull. Eur. Assoc. Fish Pathol. 1(1):15-17. (Vetbakteriol. Inst. Univ. Bern, Postfack 2735 Tierspital, CH-3001 Bern, Switzerland.).

Case report of a near-100% mortality of pike fry that yielded Egtved virus. Experimentally, the isolant was virulent for both pike and trout. (Ken Wolf).

002143.

000138

Mellergaard, S., Larsen, J. L.

1981. Hemagglutinating activity of *Aeromonas salmonicida* and *Vibrio anguillarum* strains isolated from diseased rainbow trout (*Salmo gairdneri*). Bull. Eur. Assoc. Fish Pathol. 1:26-28. (Bulowsvej 13, DK-1870 Copenhagen V, Denmark.).

Five rough and five smooth strains of *Aeromonas salmonicida* and ten strains of *Vibrio anguillarum* were tested for agglutination of six kinds of RBC and one yeast cell. Smooth strains of *Aeromonas salmonicida* agglutinated only the yeast cells. Rough strains agglutinated yeast and most RBCs. Reactions with *Vibrio anguillarum* were more complex. Tabular results are given. (Ken Wolf).

002119.

000139

Michel, C.

1982. Progress towards furunculosis vaccination. Pages 151-169 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Lab. Ichtyopathol. I.N.R.A. Route de Thiverval, 78850 Thiverval-Grignon, France.).

A review of major progress of the last 40 years is documented. Only typical strains of the bacterium are considered. (Ken Wolf).

002081.

000140

Michel, C., Faivre, B.

1982. Occurrence and significance of agglutinating antibodies in experimental furunculosis of rainbow trout, *Salmo gairdneri* Richardson. J. Fish Dis. 5(5):429-432. (Lab. Ichtyopathol. INRA, Route de Thiverval, 78850 Thiverval-Grignon, France.).

Experimental infections with a pathogenic strain of *Aeromonas salmonicida* were initiated in each of three groups of fingerlings held at 15°C. Group 1 received an i.m. injection of 3000 bacteria. Group 2 received 5000 bacteria plus 0.3 mg flumequine on days 4-6 post-injection. Group 3 received three injections of 1000 bacteria at monthly intervals. Groups 1 and 3 mounted insignificant responses of < 40 to 80, but Group 2 had maximal titers of 5000-10,000. As did earlier workers, the authors concluded that circulating agglutinins are not necessary in resistance to furunculosis. Tabular data and a discussion are included. (Ken Wolf).

002000.

000141

Moccia, R. D., Leatherland, J. F., Sonstegard, R. A.

1981. Quantitative interlake comparison of thyroid pathology in Great Lakes coho (*Oncorhynchus kisutch*) and chinook (*Oncorhynchus tschawytscha*) salmon. Cancer Res. 41:2200-2210. (Dep. Zool. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. Canada.).

This paper describes epizootiological findings of a study of thyroid pathology in coho and chinook salmon in the Great Lakes and presents a histopathological assessment of thyroid condition from an interspecies and interlake perspective. (Authors).

002089.

000142

Moller, H.

1980. Bibliography on fungus- and zooparasites in NE Atlantic fish. Pages 1-24 *in* Spec. Meet. Dis. Commercially Important Mar. Fish Shellfish, Copenhagen, Denmark, 1-3 Oct. 1980. Int. Counc. Explor. Sea 18. (Inst. Meereskunde, Univ. Kiel, Dusternbrookerweg 20, Fed. Rep. Germany.).

Together with a bibliographic review on fish diseases, that was published in 1979 in *Meeresforschung* vol. 27, pp. 217-237, this bibliography on fish diseases covers the whole field of fish pathology in Northeast Atlantic waters.

For easier handling, articles are classified according to ecological and systematic parasite groups. Only articles published later than 1900 have been regarded. Publications in Polish and Russian language are included, if abstracts in English, French or German were added. This list was closed in May 1980 and contains 622 titles. (Author).

002131.

000143

Moller, H.

1981. Fish diseases in German and Danish coastal waters in summer 1980. (Fischkrankheiten in deutschen und danischen Kustengewassern im Sommer 1980.) Meeresforschung 29(1):1-16. (Inst. Meereskunde, Univ. Kiel, Dusternbrooker Weg 20, D-2300 Kiel, Fed. Rep. Germany.).

The occurrence of externally visible diseases is described for 10 fish species from Danish and German coastal waters. Special attention was paid to estuaries of the rivers Elbe and Weser and to a dumping area in the Gorman Bight.

A comparison with literature data give no hints tc a general increase of fish diseases in the area of investigation during the last decades. The regional abundance of skin ulcers showed different patterns for several fish species. Relatively high disease rates of cod in the central German Bight are possibly attributed to a rather high population density. (Author). (Paper in German).

002132.

000144

Moller, H.

1979. Geographical distribution of fish diseases in the NE Atlantic. (Geographische Verbeitung von Fischkrankheiten im Nordostatlantik.) Meeresforschung 27(4):217-235. (Inst. Meereskunde, Univ. Kiel, Dusternbrooker Weg 20, D-2300 Kiel, Fed. Rep. Germany.).

The abundance of skeletal deformities, lymphocystis, cauliflower disease, various tumors, ulcers, and fin rot in NE Atlantic fishes is reviewed. Data on the incidence of diseases were compiled for more than a quarter million of fishes from the literature and from own investigations. New data are presented on three surveys around the North Sea and on 1971-1978 studies in the western Baltic. Seasonal and geographical fluctuations in the incidence of diseases and relations to fish length are discussed. (Author). (Paper in German).

002133.

000145

Moller, H.

1981. Field guide to the diagnosis of fish diseases and important fish parasites in North Sea and Baltic Sea. Ber. Inst. Meeresk. Kiel 86:1-65. (Inst. Meereskunde, Univ. Kiel, Aquarium, Dusternbrooker Weg 20, D-2300 Kiel, Fed. Rep. Germany.).

The object of this paper is to enable the reader to make a rapid diagnosis of the most common diseases. All important disease symptoms that have been discovered during a 5-year study in western Baltic Sea, North Sea, and in the estuaries of Weser and Elbe are demonstrated on 56 colored pictures. Diseases are included, if conspicuous by external examination or after opening the body cavity. Besides typical diseases that are caused by genetic aberration, by viral, bacterial, or fungal infections or by unknown agents, and the most striking zooparasites are regarded.

Basic information is given in German and in English, on etiology, commercial significance, geographical distribution, and relation of diseases to fish and environment. (Author).

002134.

000146

Molnar, K.

1982. Nodular coccidiosis in the gut of the tench, *Tinca tinca* L. J. Fish Dis. 5(6):461-470. (Vet. Med. Res. Inst. Hungarian Acad. Sci. H-1581 Budapest, P. O. Box 18, Hungary.).

In the intestinal epithelium of 3-5 summer old tench, *Tinca tinca* L. an unknown *Eimeria* sp. developing white, pinhead-sized nodules was found. Oocysts were shed in a non-sporulated state, but at 20°C in tap water they completed sporulation and resembled *Eimeria subepithelialis*, a parasite of common carp. During the period of examination, in April and May, only young oocysts and gamogonic stages developing in the epithelium of the mucosa were detected. Despite the morphological similarities and nodular occurrence there are significant differences between the nodular coccidiosis of the tench and common carp. (Author).

002147.

000147

Morrison, C. M., Shum, G., Appy, R. G., Odense, P., Annand, C.

1982. Histology and prevalence of X-cell lesions in Atlantic cod (*Gadus morhua*). Can. J. Fish. Aquat. Sci. 39(11):1519-1530. (Dep. Fish.

Oceans, Fish. Environ. Sci. Halifax Lab. Halifax, N.S. B3J 2S7.).

The prevalence of X-cell lesions in Atlantic cod (*Gadus morhua*) from the Canadian Atlantic was similar to that in German Bight and lower than their prevalence in *G. macrocephalus* off the west coast of Canada. The lesions, which are now believed to be xenomas composed of X-cell parasites and host cells were different from those described by other authors in that the pseudobranchs would always be seen on the exposed surface of the lesion, and were not infiltrated by X-cells. Sometimes the X-cell lesion was separate from the pseudobranch. (Authors).

002053.

000148

Mugridge, R. E. R., Stallybrass, H. G.

1983. A mortality of eels, *Anguilla anguilla* L. attributed to Gnathiidae. J. Fish Dis. 6(1):81-82. (Southern Water Authority, Lewes Road, Falmer, Brighton, England.).

A case report of an unusual infestation by a hematophagous isopod crustacean in a seawater facility. The parasite is shown in half-tone illustration, and control of the mortality was effected by changing the water supply to a fresh water source. (Ken Wolf).

002016.

000149

Mulcahy, D., Burke, J., Pascho, R., Jenes, C. K.

1982. Pathogenesis of infectious hematopoietic necrosis virus in adult sockeye salmon (*Oncorhynchus nerka*). Can. J. Fish. Aquat. Sci. 39:(8)1144-1149. (U.S. Fish and Wild. Serv. Nat. Fish. Res. Cent. Bldg. 204, Naval Support Activity, Seattle, Wash. 98115.).

The concentration of IHN virus was determined in organs and body fluids from each of 60 salmon. In prespawning females, IHN virus could be detected in all organs and in ovarian fluid but not in serum; the incidences were highest in the pyloric ceca and liver. Incidences of infection in the organs were higher in spawning than in prespawning females and higher still in spent females in which the incidence of virus was 100% in all organs except brains (78%) and sera (67%). Virus concentrations in organs or fluids ranged from 5 to 4.0×10^9 plaque-forming units per milliliter. In males, the highest incidences of virus were found in gills, pyloric ceca, and liver. The gills were the only organ in which the virus concentration in males exceeded that of females. (Authors).

002159.

000150

Munn, C. B., Trust, T. J.

1981. Bacterial diseases of fish – the molecular basis of infection and immunity. Bull. Eur. Assoc. Fish Pathol. 1:21-25. (Dep. Biol. Sci. Plymouth Polytech. Plymouth PL4 8AA, England.).

The molecular approach to the study of infection and immunity is yielding valuable information about fish diseases. In some cases, this may lead to better methods of diagnosis, e.g. by immunodiagnostic techniques for markers of infection. Preventive measures may be improved with more effective vaccines or an appreciation of how best to use them; also easier selection of resistant stock may be facilitated. It is also possible that therapeutic agents may be directed at specific parts of the disease process. (Authors).

002117.

000151

Munro, A. L. S.

1982. The pathogenesis of bacterial diseases of fishes. Pages 131-149 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (DAFS Mar. Lab. Victoria Road, Aberdeen, Scotland.).

The pathogenesis or progressive development of bacterial diseases in fishes from initiating events to some subsequent stage in the host pathogen relationship is the subject of this review. (Author).

002080.

000152

Nakai, T., Muroga, K.

1982. *Pseudomonas anguilliseptica* isolated from European eels (*Anguilla anguilla*) in Scotland. Fish Pathol. 17(2):147-150. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama, 720 Japan.).

In 1981, red spot disease occurred in European eels (*Anguilla anguilla*) in Scotland, and this seems to be the first record of the disease in Europe. Then two strains isolated in Scotland were compared with Japanese representative strains of *Pseudomonas anguilliseptica*.

According to the results of biochemical characterization tests, agglutinin reactions, precipitin reactions, and pathogenicity tests for Japanese eels (*A. japonica*) and European eels, the Scottish strains proved identical to strain no. 2, the representative strain of K antigen-lacking type (K-type) of *P. anguilliseptica*. (Authors). (Paper in Japanese).

002066.

000153

Natl., Agency Environ., Prot., Denmark, Royal Vet., Agric., Univ. Danish Inst., Fish., Mar., Res.

1982. Field investigations of fish diseases. Bull. Eur. Assoc. Fish Pathol 2(Suppl. 1):1-10. (Royal Vet. Agric. Univ. Lab. Aquat. Pathobiol. Copenhagen, Denmark.).

The title of this supplement does not exactly reflect the contents of this valuable collection of color plates of gross signs of fish diseases–primarily the external pathology of marine and estuarine fishes found in coastal Denmark. The text indicates that the pathology is believed to be influenced by terrestrial pollution. The relationship between outbreaks of a disease, as influenced by environment, and the presence of facultatively pathogenic organisms is stressed. Five environmental factors are listed as contributing to outbreaks: (1) increased infection pressure, (2) activation of latent infections, (3) chemical modification of epithelial defense barriers, (4) depressing of systemic defenses, (5) genetic and cytotoxic effects on eggs and larvae. (S. F. Snieszko).

002136.

000154

Newman, S. G., Majnarich, J. J.

1982. Direct immersion vaccination of juvenile rainbow trout, *Salmo gairdneri* Richardson, and juvenile coho salmon, *Oncorhynchus kisutch* (Walbaum), with a *Yersinia ruckeri* bacterin. J. Fish Dis. 5(4):339-341. (BioMed Res. Lab. Inc. 1115 East Pike St. Seattle, Wash. 98122.).

Juveniles of about 5 g mean weight were immersed for 2 min, and beginning 2 weeks later and at irregular intervals thereafter were challenged by injection of virulent *Yersinia ruckeri*, then observed for 2 weeks. Among salmon, the relative level of protection ranged from 76% at 18 days to 61% at 3 months post-vaccination. In trout, the protection was 70% at 15 and 45 days post-vaccination. Bacterin provided protection at approximately 8 μg dry material per milliliter. (Ken Wolf).

001968.

000155

Niyogi, A., Gupta, A. K., Agarwal, S. M.

1982. Population dynamics of caryophyllids parasitizing *Clarias batrachus* at Raipur. Geobios (new Rep.) 1(2):81-93. (Parasitol. Lab. Dep. Biosci. Ravishankar Univ. Raipur-492 010, India.).

Five-hundred eighty-two *Clarias batrachus* were examined from April 1981 through March 1982 for caryophyllid infection. Very high incidence was found in 15-30 cm range, more so in females, during March to August. During September to February, the incidence was much lesser. March to June is considered the period of recruitment while July onward rejection of worms occurs. Temperature regulated rejection response (Kennedy) is discounted here. (Authors).

002027.

000156

O'Leary, P. J., Rohovec, J. S., Sanders, J. E., Fryer, J. L.

1982. Serotypes of *Yersinia ruckeri* and their immunogenic properties. Oreg. Agric. Exp. Stn. Tech. Pap. 6235. 15 pp. (Dep. Pharmacol. Baylor Coll. Med. Texas Med. Cent. Houston, Tex. 77025.).

Seventeen cultures of *Yersinia ruckeri* isolated from diseased salmonid fish were studied by seriological and immunological methods. Based on agglutination reactions, four were found to have an antigenic composition distinctly different from that of the other thirteen. Cultures of serotype I (HI-70) differed from those of serotype II with respect to the fermentation of sorbitol. A bacterin prepared from a formalin killed culture of serotype II given intraperitoneally to juvenile rainbow trout (*Salmo gairdneri*) protected them against infection with cultures of either serotype I or II.

Bacterin made from a culture of serotype I, however, provided protection against serotype I infection, but not against serotype II. Bivalent bacterin (serotype I and II) effectively protected fish against infection with either serotype. (Authors).

002111.

000157

Obradovic, J., Maran, B., Sabocanec, R.

1983. Papillomatosis in the sheat-fish, *Silurus glanis* L. J. Fish Dis. 6(1):83-84. (Rudjer Boskovic Inst. Cent. Mar. Res. Zagreb, Yugoslavia.).

A brief nonillustrated case report of epithelial neoplasms on the skin of about 15% of a population of 150 female fish from a single pond at a Yugoslavian fish farm. The possibility of a viral etiology was not mentioned; instead the authors speculate about a possible pollution cause. (Ken Wolf).

002017.

000158

Okamoto, N., Sano, T., Hedrick, R. P., Fryer, J. L.

1983. Antigenic relationships of selected strains of infectious pancreatic necrosis virus and European eel virus. J. Fish Dis. 6(1):19-25. (Lab. Fish Pathol. Dep. Aquacult. Tokyo Univ. Fish. 4-5-7 Konan, Minato-ku, Tokyo 108, Japan.).

An antigenic comparison of 10 strains of infectious pancreatic necrosis virus (IPNV) and a single strain of European eel virus (EEV) revealed the presence of three distinct groups separable by cross-neutralization. The groups and their relationships are given in the text. (Authors).

002026.

000159

Olesen, N. J., Jorgensen, P. E. V.

1982. Can and do herons serve as vectors for Egtved virus.. Bull. Eur. Assoc. Fish Pathol. 2(3):48. (State Vet. Serum Lab. Hangovej 2, DK-8200 Arhus N, Denmark.).

Herons not previously exposed to infection were contaminated by holding in their beaks for a few seconds rainbow trout that just died from viral hemorrhagic septicemia (VHS). Fifteen minutes to a few hours later, beaks were then pressed through the musculature of noninfected rainbow trout. Trout so exposed developed VHS. (S. F. Snieszko).

002140.

000160

Paperna, I.

1983. A *Chloromyxum*-like myxosporean infection in the stomach of cultured *Sparus aurata* (L.). J. Fish Dis. 6(1):85-89. (H. Steinitz Mar. Lab. P. O. Box 469, Eliat, Israel.).

Two of 500 juvenile (35-50 mm) fish examined in histological section were found to harbor the myxosporean, but only in stomach tissues. Trophozoites were attached to the surface of the mucosal epithelium and histozoic pansporoblasts were located within the mucosa usually near the basement membrane. Well illustrated with half-tone figures and a line drawing featuring developmental stages. (Ken Wolf).

002018.

000161

Paperna, I.

1982. *Kudoa* infection in the glomeruli, mesentery and peritoneum of cultured *Sparus aurata* L. J. Fish Dis. 5(6):539-543. (H. Steinitz Mar. Biol. Lab. Hebrew Univ. of Jerusalem, P. O. Box 469, Eilat, Israel.).

An illustrated case report involving one infected specimen fish. (Ken Wolf).

002156.

000162

Paperna, I., Sabnai, I., Colorni, A.

1982. An outbreak of lymphocystis in *Sparus aurata* L. in the Gulf of Aqaba, Red Sea. J. Fish Dis. 5(5):433-437. (H. Steinitz Mar. Lab. P. O. Box 469, Eilat, Israel.).

A case report of the viral infection in a marine species under husbandry. A low incidence was observed among fish in offshore cages, but when transferred to inshore tanks and held at high den-

sity, the infection soon occurred in all fish. Mortality did not occur, and the disease disappeared within several weeks. All attempts at experimental infections failed. Light and electron micrographs are provided. (Ken Wolf).

001974.

000163

Paperna, I., Sabnai, I., Colorni, A.

1982. An outbreak of lymphocystis in *Sparus aurata* L. in the Gulf of Aqaba, Red Sea. J. Fish Dis. 5(5):433-437. (H. Steinitz Mar. Lab. P. O. Box 469, Eilat, Israel.).

First report of lymphocystis in marine fish under husbandry. A 100% incidence was observed when a group of fish known to harbor a low incidence of the disease was transferred to holding tanks. No mortality occurred however, and the lesions disappeared within a month. Light and electron micrographs are included in the report. (Ken Wolf).

001999.

000164

Pastuszko, J., Jastrzebski, M.

1981. Coccidiosis of fresh-water fish in the light of literature. (Kokcydioza Ryb Slodkowodnych W Swietle Literatury.) Wiad. Parazytol. 27(6):745-751. (Zaklad Chorob Pasozytniczych, Inst. Chorob Zakaznych i Inwazyjnych, Wydz. Wet. SGGW-AR, Warszawa, Poland.).

The authors have reviewed the world literature concerning coccidia of fresh-water fish and presented a list of coccidia species that probably occur in Poland. (Authors). (Paper in Polish).

002101.

000165

Pickering, A. D., Willoughby, L. G.

1982. *Saprolegnia* infections of salmonid fish. Pages 271-297 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Freshw. Biol. Assoc. Ferry House, Far Sawrey, Nr. Ambleside, Cumbria, England.).

The authors state, "The purpose of this review is to examine the nature of such infections, with particular emphasis being given to those of salmonid fish, and to identify those conditions that promote the outbreak of fungal diseases". The authors draw heavily on their own work but present their review in a broader framework of international literature. (Ken Wolf).

002085.

000166

Pulsford, A., Matthews, R. A.

1982. An ultrastructural study of *Myxobolus exiguus* Thelohan, 1895 (Myxosporea) from grey mullet, *Crenimugil labrosus* (Risso). J. Fish Dis. 5(6):509-520. (Mar. Biol. Assoc. U. K. The Lab. Citadel Hill, Plymouth PL1 2PB, England.).

An ultrastructural study of *Myxobolus exiguus* Thelohan, 1895 using interlamellar and subdermal plasmodia from thick-lipped grey mullet, *Crenimugil labrosus*, revealed differences in the structure of the plasmodia and host tissue reaction. Both plasmodia showed structural evidence of pinocytotic acitivity. A filamentous glycocalyx was a feature of the surface membrane. Mature spores were oval, measuring 9.0 μ*m $\times$ 7.5 μm. Sporogenesis and capsulogenesis were essentially similar to other myxosporea usually well illustrated. (Authors).

002152.

000167

Ratliff, D. E., Hill, R. L., Groberg, W. J. Jr.

1982. Infectious hematopoietic necrosis: a comparison of epizootics among fry hatched from saline-rinsed and unrinsed steelhead eggs. Prog. Fish-Cult. 44(4):217-220. (Portland Gen. Elec. Co. Dep. Environ. Sci. Madras, Oreg. 97741.).

The work was undertaken to determine whether removal of ovarian fluid by rinsing eggs in saline before fertilization would dilute virus and decrease the incidence of infectious hematopoietic necrosis in resulting fry. Overall, results from eggs that were rinsed were similar to those that were not rinsed. The data were not consistent. (Ken Wolf).

002059.

000168

Ribeiro, L., Ahne, W.

1982. Fish cell culture: initiation of a line of pituitary cells from carp (*Cyprinus carpio*) to study the release of gonadotropin in vitro. In Vitro 18(5):419-42. (Inst. Zool. Hydrobiol. Munich, Kaulbachstrabe 37, D-8000 Munich 22, Fed. Rep. Germany.).

A cell line was initiated from carp pituitaries. Growth was best at 30°C at seeding levels of 6×10^5 cells/mL. Primary cultures produced gonadotropin (GtH) in vitro and 1.45 ng of GtH was secreted by 6×10^5 cells in 4 h at 25°C. The cell line at present is in 57th passage. (Authors).

001990.

000169

Roitman, V. A., Voejkov, J. A., Spirin, S. L.

1981. The finding of *Aspidogaster limacoides* (Diesing, 1834) (Aspidogastrea) in fishes from the Rybinsk water reservoir. Parasitologia 15(4):332-337. (Lab. Helminthol. AN, USSR, Moscow.).

The finding of *Aspidogaster limacoides* in fishes from the Rybinsk water reservoir is first reported herein. In 1978 the single helminth of this species was found in one bream of 18 examined and in 1980,in 18 of 21 examined roaches, the infection intensity being 1 to 105 specimens. The prevailing number of aspidogasters was localized in the initial parts of the anterior portion of the intestine. (Authors). (Paper in Russian).

002087.

000170

Romero, R. C., Kuroki, H. B.

1981. *Lepeophtheirus dissimulatus* Wilson 1905 and *Lepeophtheirus zbigniewi* new species (Copepoda: Caligidae) parasites of inshore fishes from the Pacific Coast of Chile, South America. Bull. Mar. Sci. 31(2):318-328. (Inst. Invest. Ocean. Univ. Chile, Casilla 1240, Antofagasta, Chile.).

The first record of the genus *Lepeophtheirus* Nordmann, 1832, from the Chilean waters was published by Edwards (1840), who described under the name *Caligus ornatus* a species he recognized as belonging to Nordmann's *Lepeophtherius*. Transferred to *Lepeophtheirus* by Bassett-Smith (1899), this species was eventually synonymized with *L. nordmanni* (Edwards, 1837) by Stuardo (1958). Other species of *Lepeophtheirus* described from Chile are: *L. chilensis* Wilson, 1905, found on a 'ray' and on *Sebastes* sp. *L. interitus* Wilson, 1921, from *Polyprion oxygeneios*; *L. yanezi* Stuardo, and Fagetti, 1961, from *Genypterus maculatus* and *G. chilensis* and *L. selkirki* Atria, 1969, from *Hectoria oxygeneios*. This paper presents the first record of *L. dissimulatus* Wilson, 1905, from Chile and on a new host species. Also a new species of *Lepeophtheirus* from a Chilean fish is described. (Authors).

001992.

000171

Rosenberg-Wiser, S., Avtalion, R. R.

1982. The cells involved in the immune resonse of fish. III. Culture requirements of PHA-stimulated carp (*Cyprinus carpio*) lymphocytes. Dev. Comp. Immunol. 6(4):693-702. (Dep. Life Sci. Bar-Ilan Univ. Ramat-Gan 52 100, Israel.).

Culture conditions for peripheral lymphocytes was studied using thymidine uptake. The quantitative and/or qualitative requirements were determined with respect to serum, the concentrations of 2-ME, glutamine, and PHA, and cell density. High individual variations were found. Variations were reduced and the mitogenic response enhanced by addition of charcoal adsorbed pooled homologous serum (4%), 2-ME (125-250 μM), glutamine (8 mM), PHA (10-40 μL per mL) and by seeding cells at the optimal density. The peak response was obtained between days 6 and 7 at 28°C. (Authors).

002068.

000172

Sakai, D. K.

1982. Determination of health status and nonspecific complement activities in the sera of salmonid fishes. Bull. Eur. Assoc. Fish Pathol. 2:32-34. (Hokkaido Fish Hatch. Nakanoshima-2, Toyohira, Sappro 062, Japan.).

The titration of the SH_{50} activity of the sera of fish gives an index for evaluating health. The activity was dependent on the nutritional status and could be eliminated by virulent *Aeromonas salmonicida* and *Vibrio anguillarum* but not by avirulent *A. salmonicida*. The SH_{50} units are a measure of the complement-dependent nonspecific de-

fense mechanisms, whereas the CH_{50} is due to specific antibody. (D. P. Anderson).

002114.

000173

Santacana, J. A., Conroy, D. A., Mujica, M. E.

1982. Acid-fast bacterial infection and its control in three-spot gouramies, *Trichogaster trichopterus* Pallas. J. Fish Dis. 5(6):545-547. (Fac. Ciencias Vet. Univ. Cent. Venezuela, Maracay, Venezuela.).

A case report involving mortality of 35% over a month long period. Etiology was determined in stained histologic sections. Control was achieved with 100 ppm kanamycin sulfate administered as a continuous bath for 5 consecutive days. (Ken Wolf).

002157.

000174

Satpute, L. R., Agarwal, S. M.

1980. Morphology and systematics of *Djombangia indica* Satpute & Agarwal, 1974 causing diverticulosis of duodenum of *Clarias batrachus* (Linn). Proc. Indian Acad. Parasitol. 1(2):13-16. (Dep Biosci. Ravishankar Univ. Raipur M.P. India.).

Structure of *Djombangia indica* causing diverticulosis of duodenum of *Clarias batrachus* is described in detail. (Authors).

002030.

000175

Satpute, L. R., Agarwal, S. M.

1980. Studies on seasonal infection of *Clarias batrachus* (Linn) by *Lytocestus indicus* Moghe, 1925. Indian J. Helminthol. 32(1):9-17. (Dep. Biosci. Ravishankar Univ. Raipur 492 010 M.P. India.).

Ten to 20 *Clarias batrachus* from each of six sites were examined fortnightly and a record of specimens infected with *Lytocestus indicus* was maintained for 2 years. Six tables of results are given. (Authors).

002031.

000176

Saxena, O. P., Yadav, R. S.

1981. Spontaneous epidermal neoplasm in freshwater aquarium fish *Xiphophorus maculatus* (Gunther). Curr. Sci. (Bangalore) 2:101-102. (Zool. Res. Lab. M.M. College, Modinagar 201 204, India.).

Case report of an epidermal papilloma with histochemical reactivity of a lipoma. (Ken Wolf).

002096.

000177

Schwedler, T. E., Plumb, J. A.

1982. Golden shiner virus: effects of stocking density on incidence of viral infection. Prog. Fish-Cult. 44(3):151-152. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36849.).

Golden shiners from a pond were virologically assayed for the golden shiner virus disease. A 2.8% incidence was shown among 36 fish that were sampled. Other fish were stocked in experimental tanks at densities of 12.5 g/L or 6.25 g/L and held for 8 days at 25-28°C. At 48 h five of 10 fish from the lot at heavier stocking density showed virus, and the mean titer was $10^{3.3}$ $TCID_{50}$ per gram of fish tissue. Virus was also recovered from the water at $10^{2.5}$ to $10^{2.8}$ $TCID_{50}$ per mL. Virus was recovered from only one of 10 fish from the lighter stocking density. The titer was $10^{2.5}$ $TCID_{50}$ per gram of tissue. No virus was recovered from the water. (Ken Wolf).

001982.

000178

Schwedler, T. E., Plumb, J. A.

1982. In vitro growth kinetics and thermostability of the golden shiner virus. J. Wildl. Dis. 18(4):441-446. (Dep. Fish. Allied Aquacult. Auburn Univ. Agric. Exp. Stn. Auburn, Ala. 36830.).

In vitro replication of the golden shiner virus (GSV) occurred at 20 to 30°C in fathead minnow

cells; GSV did not replicate at 15 or 35°C. Optimal replication temperature was approximately 30°C, where the latent period was 8 h and viral yield was 113 infectious units per cell. Maximum cytopathic effect coincided with maximum released viral titer. Suitable storage temperatures for GSV were -70°C and 4°C. Viral infectivity was rapidly lost at temperatures above 20°C and at normal freezer temperature (-15°C). (Authors).

002007.

000179

Smith, P. R., Brazil, G. M., Drinan, E. M., O'Kelly, J., Palmer, R. Scallan, A.

1982. Lateral transmission of furunculosis in sea water. Bull. Eur. Assoc. Fish Pathol. 2(3):41-42. (Fish Dis. Group, Dep. Microbiol. Univ. Coll. Galway, Ireland.).

Salmon smolts from a hatchery free of furunculosis, placed in sea cages and exposed 8 days later to infected carrier fish, became infected with *Aeromonas salmonicida*. Mortalities started 20 days after addition of carriers, and eventually 70% died. An example of transmission of furunculosis in sea water. (S. F. Snieszko).

002137.

000180

Song, Y. L., Kou, G. H., Chen, K. Y.

1982. Vaccination conditions for the eel (*Anguilla japonica*) with *Edwardsiella anguillimortifera* bacterin. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:18-25. (Dep. Zool. Coll. Sci. Natl. Taiwan Univ. Taipei, Taiwan, Rep. China.).

Best immune response was obtained in a formalin killed bacterin with 10^8 cells per mL and 0.15% bentonite as an adjuvant. An immersion time of 3 min was required to induce immunity in the treated eel. Single exposure to the bacterin was effective. However, better response was observed in triple exposure. Effective immunization could be induced in 6 g elvers, and the protection lasted for 10 weeks at room temperature (Authors).

002041.

000181

Sorimachi, M.

1982. Susceptiblity of fish cell lines to eel viruses. Fish Pathol. 17(2):119-123. (Natl. Res. Inst. Aquacult. Fish. Agency, Tamaki-cho, Mie, Japan.).

Susceptibilities of seven fish cell lines, RTG-2, CHSE-214, FHM, EPC, CSF-1, EK-1, and EO-2 cells, to 5 eel viruses, EV-I (EVE), EV-II, EV-III (EVEX), EV-IV, and EV-V were studied.

The viruses were subcultured 3-5 times on monolayer cell sheets in microplates at 20°C and susceptibilities were determined by the replication titers calculated by $TCID_{50}$ analysis.

Among the fish cell lines both EK-1 and EO-2 cells derived from Japanese eel exhibited the highest susceptibility to all the eel viruses except EV-II. RTG-2 and CHSE-214 cells showed next higher susceptibility to them. On the other hand, FHM, EPC, and CSF-1 cells showed low susceptibility to all these eel viruses. Titers of EK-1 and EO-2 cells to the eel viruses were observed to be more constant than those of RTG-2 and CHSE-214 cells during subcultures. (Author). (Paper in Japanese).

002063.

000182

Sorimachi, M., Sako, H.

1982. Infectious pancreatic necrosis virus (IPNV) isolated from anadromous amago, *Oncorhynchus rhodurus*. Fish Pathol. 17(2):115-118. (Natl. Res. Inst. Aquacult. Fish. Agency, Tamaki-cho, Mie, Japan.).

Virological examination was carried out on the kidney and spleen of anadromous amago caught in 1981. Tissue extracts were inoculated onto CHSE-214 cells. Virus that exhibitied cytopathic effect were isolated from 9 of 71 fish from Nagara River and 1 of 4 fish from Miyagawa River. Isolates both from Nagara River and Miyagawa River were neutralized by anti-IPNV (Gifu) rabbit serum, indicated that they were antigenically related to IPN virus. Among 71 sera of fish from Agara River, 20 specimens showed the neutralization titer over 1:8 against IPNV. The source of virus was discussed in relation to the released stock cultured in pond. (Authors). (Paper in Japanese).

002062.

000183

Stewart, D. J., Woldemariam, K., Dear, G., Mochaba, F. M.

1983. An outbreak of Sekiten-byo among cultured European eels, *Anguilla anguilla* L. in Scotland. J. Fish Dis. 6(1):75-76. (Dep. Biol. Sci. Heriot-Watt Univ. Chambers St. Edinburgh EH1 1HX, Scotland.).

A case history of an outbreak caused by *Pseudomonas anguilliseptica*. Translated, Sekiten-byo means red spot disease, but the authors wish to distinguish this condition from the more widely known red spot disease caused by *Vibrio anguillarum*. The outbreak began with the introduction of 70,000 elvers to a closed system holding 3900 healthy adults. Eventual losses claimed 96% of the elvers and about 4% of the adults. Control was achieved by elevating the temperature from 21°C to 26-27°C and holding it there for 2 weeks. (Ken Wolf).

002014.

000184

Swanson, R. N., Carlisle, J. C., Gillespie, J. H.

1982. Pathogenesis of infectious pancreatic necrosis virus infection in brook trout, *Salvelinus fontinalis* (Mitchill), following intraperitoneal injection. J. Fish Dis. 5(6):449-460. (Dep. Vet. Microbiol. New York State Coll. Vet Med. Cornell Univ. Ithaca, N. Y. 14853.).

Virus entered the peritoneal cavity and by 2 days post-inoculation virus had interacted with the pancreatic exocrine cells. Replication in these cells resulted in the production of IPNV-specific antigen, necrosis of infected cells, and spread of infectious virus to adjacent tissue. Areas of viral replication were at first multifocal but tended to merge as they grew. Eventually, most of the acinar tissue became involved and only small pockets of normal acinar cells remained. Twelve-week old brook trout survived with only a small amount of functional exocrine pancreas and limited virus replication continued in this tissue for weeks. Extensive virus replication appeared to take place only in the pancreas although viral antigen and slight pathological changes were found in the renal interstitium and livers of some fish. (Authors).

002146.

000185

Tave, D., Bartels, J. E., Smitherman, R. O.

1983. Saddleback: a dominant, lethal gene in *Sarotherodon aureus* (Steindachner) (= *Tilapia aurea*). J. Fish Dis. 6(1):59-73. (Dep. Entomol. Fish. Wildl. Univ. Minnesota, St. Paul, Minn. 55108.).

S, a dominant, lethal, autosomal gene, was discovered in Auburn University's population of *Sarotherodon aureus* (= *Tilapia aurea*). When present in the heterozygous state (S), the S gene produces the saddleback phenotype. Saddlebacks are missing part of or all of the dorsal fin. Some fish that are missing most of or the entire dorsal fin have additional fin disorders and are missing various combinations of the pectoral, pelvic, and anal fins. Each fin disorder is associated with gross skeletal anomalies. Viability in saddlebacks is reduced by 67% during the first 3 months of life. When present in the homozygous state (SS), the gene causes death in fry prior to swim-up. (Authors).

002013.

000186

Tave, D., Bartels, J. E., Smitherman, R. O.

1982. Stumpbody *Sarotherodon aureus* (Steindachner) (= *Tilapia aurea*) and tail-less *S. niloticus* (L.) (= *T. nilotica*): two vertebral anomalies and their effects on body length. J. Fish Dis. 5(6):487-494. (Dep. Fish. Allied Aquacult. Alabama Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36830.).

Two gross phenotypic anomalies in tilapia are descriped: stumpbody *Sarotherodon aureas* (= *Tilapia aurea*) and tail-less *S. niloticus* (= *T. nilotica*). Vertebral anomalies associated with each disorder are described. A body length: vertebra length ratio is developed to assess the effects that vertebral anomalies have on body lengths. The stumpbody phenotype is a non-heritable, congenital defect. (Authors).

002150.

000187

Thune, R. L., Graham, T. E., Riddle, L. M., Amborski, R. L.

1982. Extracellular protease from *Aeromonas hydrophila*: partial purification and effects on age-0 channel catfish. Trans. Am. Fish. Soc. 111(6):749-754. (Dep. Vet. Microbiol, Parasi-

tol. Vet. Sci. Louisiana State Univ. Baton Rouge, La. 70803.).

Extracellular products from *Aeromonas hydrophila* strain 22 grown in a defined medium were lethal to young-of-the-year channel catfish *Ictalurus punctatus*. No detectable hemolysin was produced, but partial purification and characterization of the extracellular products suggested that the lethal factors were proteases. The median lethal dose (LD50) of a heat-labile protease fraction was 18.0 μg protein per gram of fish. A heat-stable protease fraction gave an LD50 of 3.0 μg protein per gram of fish. (Authors).

002060.

000188

Thune, R. L., Plumb, J. A.

1982. Effect of delivery method and antigen preparation on the production of antibodies against *Aeromonas hydrophila* in channel catfish. Prog. Fish-Cult. 44(1):53-54. (Dep. Fish. Allied Aquacult. Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36849.).

Hyperosmotic infiltration (HI) seems to be a practical alternative to injection as a method for vaccinating channel catfish. Further refinements in delivery methods regarding time of exposure, salt concentration, antigen concentration and preparation, as well as studies to determine protection against challenge, may further increase the effectivness of HI as a method for immunizing channel catfish. (Authors).

002126.

000189

Toranzo, A. E., Barja, J. L., Hetrick, F. M.

1982. Survival of *Vibrio anguillarum* and *Pasteurella piscicida* in estuarine and fresh waters. Bull. Eur. Assoc. Fish Pathol. 2(3):43-45. (Dep. Microbiol. Fac. Biol. Univ. Santiago de Compostella, Spain.).

Pure culture suspensions of actively growing bacteria were added to filtered tap water and to filtered Chesapeake Bay (North America) estuarine water (12 ppt salinity). *Vibrio anguillarum* was monitored at 20°C and survived at least 100 days in salt water. It could not be recovered from fresh water after 10 days. *Pasteurella piscicida* survived no longer than 5 days in both types of water. Accordingly, carrier fish are much more important in infection of fish with *P. piscicida* than with *V. anguillarum*. (S. F. Snieszko).

002138.

000190

Ubgade, S. R., Agarwal, S. M.

1980. Morphology and life history of *Azygia papillata* n. sp. (Trematoda: Azygiidae). Indian J. Parasitol. 4(2):111-118. (Dep. Biosci. Ravishankar Univ. Raipur-492 010 MP, India.).

The life history of *Azygia papillata* n. sp. parasitizing *Channa marulius* (Ham.) and *Vivipara bengalensis* (Lam.), has been worked out experimentally. Adults lay fully embryonated eggs which are ingested by snails while rasping food. Eggs hatch in the intestine of snails. Miracidia penetrate the wall of intestine and transform into sporocyst in the connective tissue wall. Two generations of rediae are produced (mother rediae and daughter rediae). Cercariae are produced by both mother and daughter rediae. (Authors).

002029.

000191

Urdaneta, H. E.

1982. Lymphocystis in robalo, *Centropomus undecimalis* (Bloch), in Lake Maracaibo, Venezuela. J. Fish Dis. 5(4):347-348. (Cent. Invest. Biol. Fac. Humanidades Educ. Univ. Zulia, Apartado de Correos No. 526, Maracaibo, Edo. Zulia. Venezuela.).

Case report of a 35% incidence that was diagnosed visually and confirmed histologically. (Ken Wolf).

001966.

000192

Ward, P. D.

1982. The development of bacterial vaccines for fish. Pages 47-58 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (Wellcome Res. Lab. Langley Court, Beckenham, Kent, England.).

A brief review consisting of text under the following headings: the concept of immunizing fish, identification of disease problems and potential

vaccines, production, and testing. The author correctly anticipates growth in the number or kinds of bacterins, and development of preparations for use against viral and parasitic diseases. (Ken Wolf).

002076.

000193

Wier, W., Mayberry, L. F., Kinzer, H. G., Turner, P. R.

1983. Parasites of fishes in the Gila River drainage in southwestern New Mexico. J. Wildl. Dis. 19(1):59-60. (Dep. Entomol. Plant Pathol. New Mexico State Univ. Las Cruces, N. Mex. 88003.).

This study was undertaken to determine the prevalence of parasites of fishes from Feb. 1977 to August 1978. (Authors).

002112.

000194

Wolf, K.

1982. Newly discovered viruses and viral diseases of fishes, 1977-1981. Pages 59-90 *in* R. J. Roberts, ed. Microbial diseases of fish. Academic Press, London. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

A review. The material covers 11 viruses that were isolated during the 5 years covered plus a total of 15 viruses and virus-like forms that were visualized. From these entities that have historically been considered 'fish viruses,' two deletions are proposed–the grunt fin agent and the kidney tumor agent. (Author).

002077.

000195

Wolf, K, Ahne, W.

1982. Fish cell culture. Pages 305-328 *in* K. Maramorosch, ed. Advances in cell culture, vol. 2. Academic Press, Inc. New York. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

A review chapter consisting of an introduction and sections on physiological salines, media, methods, applications, and needed developments. (Authors).

002034.

000196

Wu, J. L., Chao, W. J.

1982. Isolation and application of a new bacteriophage, Phi ET-1, which infect *Edwardsiella tarda*, the pathogen of Edwardsiellosis. Comm. Agric. Plann. Dev. Rep. China No. 8, Fish Dis. Res. 4:8-17. (Inst. Zool. Acad. Sinica, Taipei, Taiwan 115, Rep. China.).

The bacteriophage was isolated from one of the 350 screened water samples. It had wide spectrum of host range by showing 92.6% virulence in 27 strains of *Edwardsiella tarda* and showed rapid lysis. The viable *E. tarda* could be reduced to less than 0.1% of the starting concentration by Phi ET-1 infection at an M.O.I. = 0.08 in 8 h. Immersion of loaches *Misgurnus anguillicaudatus* in *E. tarda* suspension was chosen for assessment of biological control. The pathogenicity of *E. tarda* was almost completely eliminated after 8 h by Phi ET-1 infection at an M.O.I. = 0.1. The shorter time of infection (2 or 4 h) and lower M.O.I. (0.01, 0.001, 0.0001) of infection by Phi ET-1, the pathogenicities of *E. tarda* were partially retained. By the above data, the biological control of *E. tarda* by Phi ET-1 is feasible. (Authors).

002086.

000197

Yu, K. K. Y., Macdonald, R. D., Moore, A. R.

1982. Replication of infectious pancreatic necrosis virus in trout leucocytes and detection of the carrier state. J. Fish Dis. 5(5):401-410. (Dep. Biol. Univ. Calgary, Alberta, Canada.).

The exact cellular site of replication of infectious pancreatic necrosis virus (IPNV) in carrier fish is unknown. In order to determine if IPNV replicates in trout leucocytes, we purified leucocytes from normal (non-carrier) trout and separated cells into an adherent and nonadherent population. Infectious pancreatic necrosis virus replicated in less than 0.01% of the adherent leucocytes with a yield of about 400 PFU/cell. Infectious pancreatic necrosis virus also became associated with less than 0.07% of the nonadherent leucocytes; either IPNV did not replicate in these cells or the yield was, at best, only a few PFU/cell. Trout persistent-

ly infected with IPNV (carrier fish) were tested for the presence of IPNV in leucocytes by co-cultivating with a sensitive fish cell line; this same population of trout was also tested for IPNV by organ sampling using standard methods. Ninety-eight per cent of the trout were positive for IPNV by organ sampling, but only 75% yielded IPNV from leucocytes. Thus a blood sample from a living fish can be used to detect the presence of IPNV. (Authors).

001978.

000198

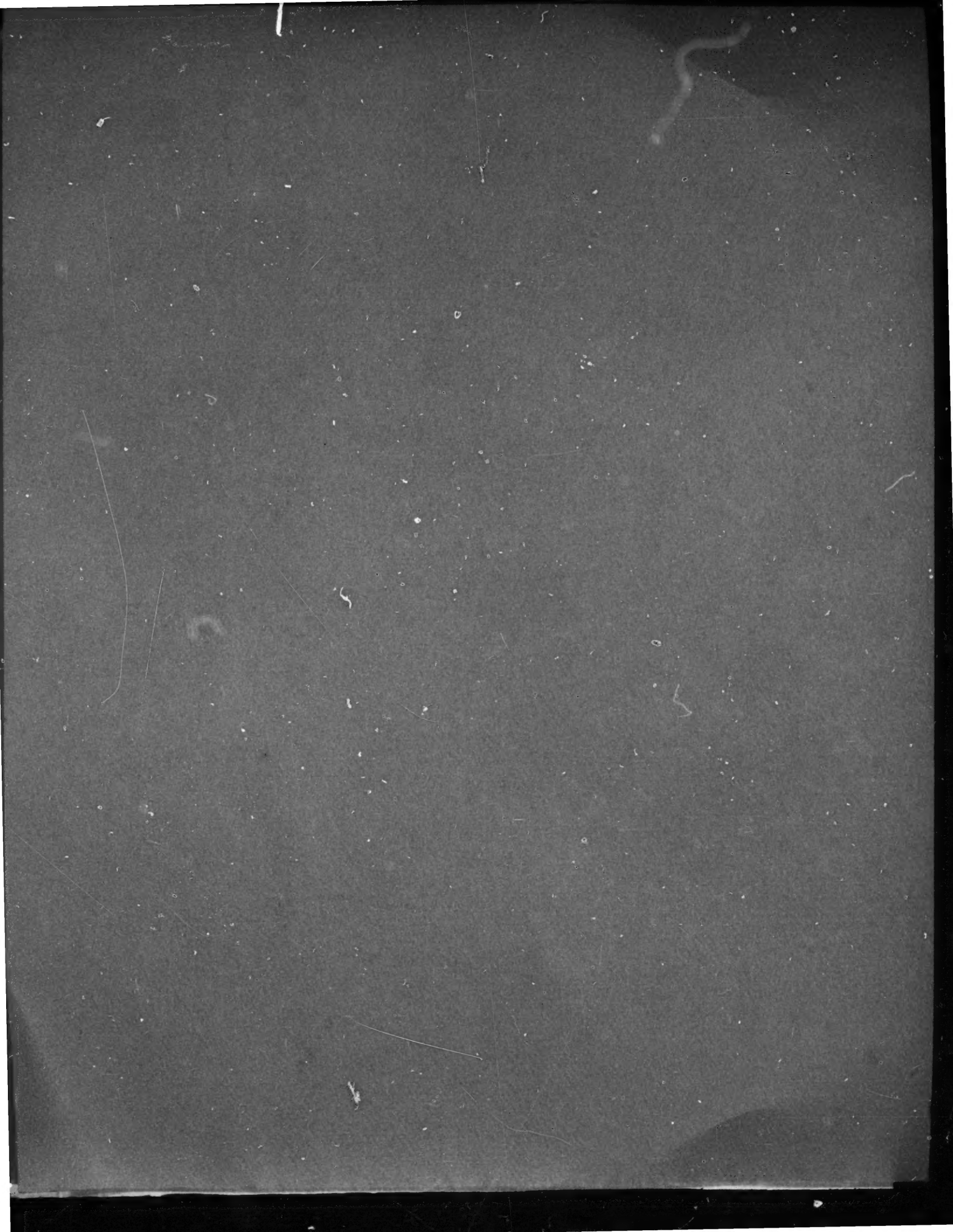
Yu, K. K. Y., Macdonald, R. D., Moore, A. R.

1982. Replication of infectious pancreatic necrosis virus in trout leucocytes and detection of the carrier state. J. Fish Dis. 5(5):401-410. (Dep. Biol. Univ. Calgary, Alberta, Canada.).

Infectious pancreatic necrosis virus (IPNV) replicated in less than 0.01% of adherent leucocytes with a yield of about 400 pfu/cell. Infectious pancreatic necrosis virus also became associated with less than 0.07% of nonadherent leucocytes; either IPNV did not replicate in these cells or the yield was, at best, only a few pfu/cell. Trout persistently infected with IPNV (carrier fish) were tested for the presence of IPNV in leucocytes. Ninety-eight per cent of the trout were positive for IPNV by organ sampling, but only 75% yielded IPNV from leucocytes. Thus a blood sample from a living fish can be used to detect the presence of IPNV. (Authors).

002003.

*U.S. Government Printing Office : 1983 - 405-199/1087



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THE DEPARTMENT OF THE INTERIOR

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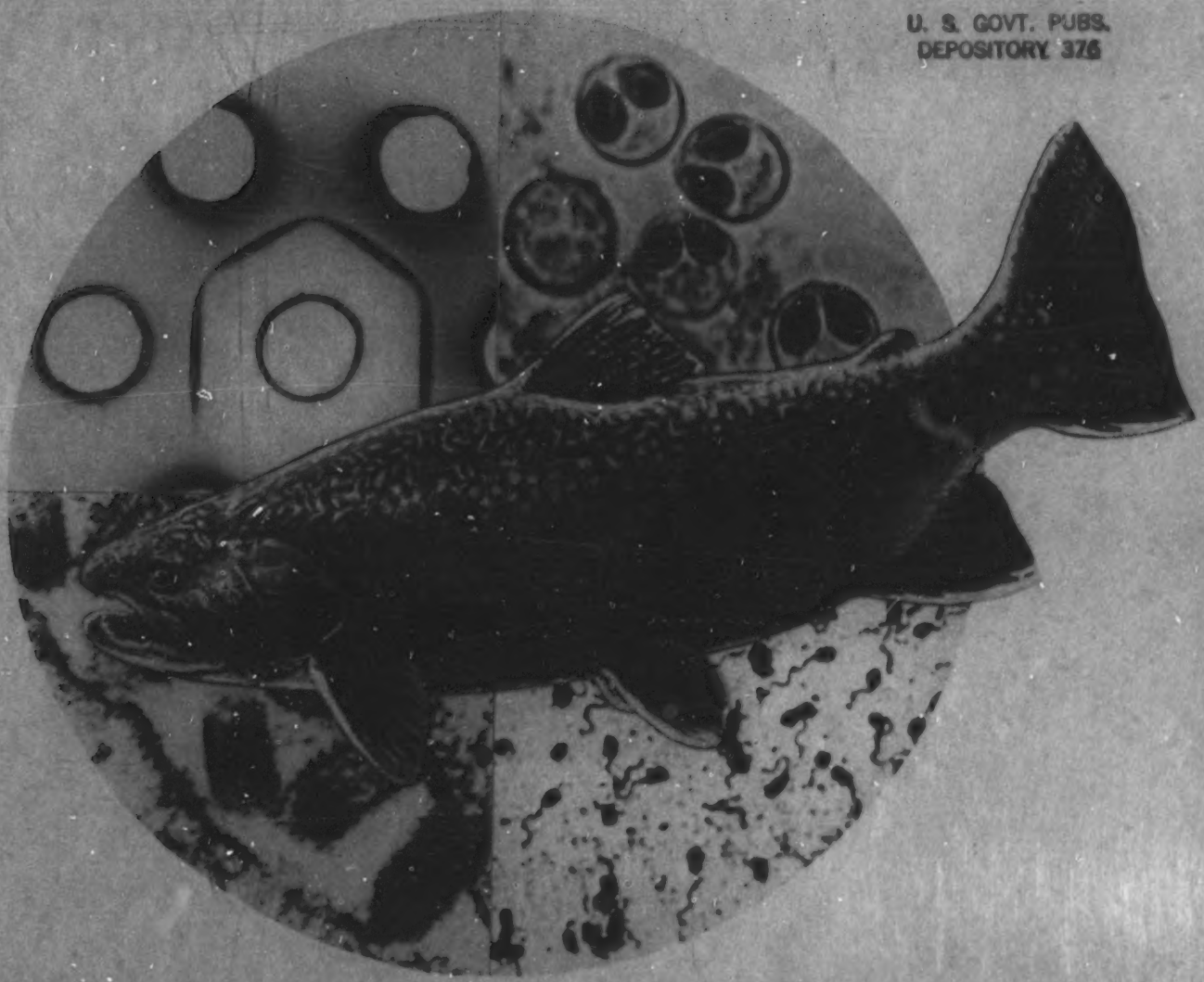

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000001

Agius, C., Horne, M. T., Ward, P. D.

1983. Immunization of rainbow trout, *Salmo gairdneri* Richardson, against vibriosis: comparison of an extract antigen with whole cell bacterins by oral and intraperitoneal routes. J. Fish Dis. 6(2):129-134. (Sch. Chem. Phys. Sci. Kingston Polytech. Kingston, Surrey, England.).

An extract vaccine against *Vibrio anguillarum* was compared with other vaccine preparations when administered to rainbow trout intraperitoneally or orally on food. Intraperitoneal vaccination resulted in virtually 100% protection within 2 weeks whereas oral vaccination gave a maximum protection of 50-70% after 8 weeks. When administered intraperitoneally the extract performed better than formalin killed cells but when administered orally formalin killed cells were better. The addition of alum as adjuvant enhanced the response to antigen administered by both routes. Serum agglutinin titers after oral vaccination were low and variable but after intraperitoneal injection they reached a consistent peak of 64. As the response to oral vaccination was so low it was not possible to relate agglutinin titer to protection in a quantitative relationship. (Authors).

002188.

000002

Ahne, W., Popp, W., Hoffmann, R.

1982. *Pseudomonas fluorescens* as a pathogen for tench *Tinca tinca*. Bull. Eur. Assoc. Fish Pathol. 2(4):56-57. (Inst. Zool. Hydrobiol. Univ. Munich, Kaulbachstrasse 37, D-8000 Munchen 22, Fed. Rep. Germany.).

Case report of an epizootic among tench fry in which mortality during a 4-week period was 90%. Virological examination was negative, but a bacterium was isolated from skin lesions and internal organs. When injected intraperitoneally, the bacterium produced 100% mortality within 10 days. (Ken Wolf).

002180.

000003

Aho, J. M., Camp, J. W., Esch, G. W.

1982. Long-term studies on the population biology of *Diplostomulum scheuringi* in a thermally altered reservoir. J. Parasitol. 68(4):695-708. (Dep. Biol. Wake Forest Univ. Winston-Salem, N. C. 27109.).

The prevalence and mean infrapopulation density of *Diplostomulum* metacercariae were monitored for 53 months in populations of mosquitofish, *Gambusia affinis*, located in ambient and thermally altered locations in Par Pond, a 1012-ha cooling reservoir located on the Savannah River Plant near Aiken, South Carolina. (Authors).

002226.

000004

Amend, D. F., Goven, B. A., Elliot, D. G.

1982. Etomidate: effective dosages for a new fish anesthetic. Trans. Am. Fish. Soc. 111(3):337-341. (Tavolek Inc. 2779 152nd Ave. N.W. Redmond, Wash. 98052.).

Etomidate (r-(+)-ethyl-1-(1-phenylethyl)-1H-imidazole-5-carboxylate) is a potent and safe anthesthetic for fish. The minimum effective dose for four species of aquarium fish ranged from 2.0 to 4.0 mg/liter, and the maximum safe dose ranged from 7.0 to 20.0 mg/liter. In general, the lower the dose, the longer the time for anesthesia, but the faster the recovery time. At 4.0 mg/liter, fish typically entered anesthesia within 90 s and recovered within 40 min. Etomidate is more effective in alkaline water and higher water temperature but is not affected by total hardness. Test species varied in their ability to survive extended or repeated exposures to the drug. Etomidate has advantages over other commonly used fish anesthetics and should be evaluated further. (Authors).

002242.

000005

Appy, R. G., Burt, M. D. B.

1982. Metazoan parasites of cod, *Gadus morhua* L. in Canadian Atlantic waters. Can. J. Zool. 60(7):1573-1579. (Dep. Biol. Univ. New Brunswick, Fredericton, N. B. Canada E3B 6E1.).

From July to September 1975, 739 Atlantic cod, *Gadus morhua* L. were collected in the Bay of Fundy, Nova Scotia shelf, and southern Gulf of St. Lawrence and were examined for metazoan parasites. Of 49 parasites recorded, 10 were considered more or less specific to cod or related gadid hosts, nine were considered accidental infections, and the remaining majority of parasites were apparently capable of infecting a wide range of unrelated marine fishes. The general lack of strict host specificity of enteric parasites of northern marine fishes results in a very diverse parasite fauna in fish such as cod which have very broad feeding habits. (Authors).

002207.

000006

Awakura, T., Kojima, H., Sugiwaka, K.

1981. Studies on parasites of masu salmon, *Oncorhynchus masou*–I. The parasitism of *Tetraonchus* (Monogenea) on the gills of juveniles in fresh water. Sci. Rep. Hokkaido Fish Hatchery 36:57-63. (Lab. Fish Pathol. Hokkaido Fish Hatchery, Hokkaido, Japan.).

Tetraonchus awakurai, Ogawa and Egusa 1978, commonly parasitized the gills of juvenile masu salmon inhabiting four rivers. Prevalence and intensity of *T. awakurai* was high in summer in 0 juveniles, in winter and spring in the stream resident parr of 1 or 2 juveniles and May and June in the silvery parr and smolt of 1 or 2 juveniles in the Atsuta River. They parasitized fish which escaped from rearing ponds and grew wild in reservoir, but we could not find the parasite on the juveniles reared in the pond located downstream of this reservoir. The parasitism of this parasite was very rare in juveniles reared in hatcheries or fish farms in Hokkaido. (Authors). (Paper in Japanese).

002197.

000007

Awakura, T., Kojima, H., Sugiwaka, K. I.

1981. Studies on parasites of masu salmon *Oncorhynchus masou*–II. The sporozoan parasites found in kidney. Sci. Rep. Hokkaido Fish Hatchery 36:65-73. (Lab. Fish. Pathol. Hokkaido Fish Hatchery, Hokkaido, Japan.).

A total of 1327 juvenile, maturing or mature masu salmon caught in rivers, off shore, and in fish ponds, and a total of 377 mature chum salmon, mature pink salmon, pond-reared coho salmon, pond-reared rainbow trout, and juvenile white spotted char (*Salvelinus leucomaenis*) were examined for sporozoan parasites in the kidneys. Haplosporidia-like organisms which were reported by Kubota and Kamada 1972, and *Myxidium* sp. which is a new record from salmonid fish in Japan were found in the kidneys of juvenile, maturing and mature masu salmon. Haplosporidia-like organisms were obeserved in the glomeruli and renal tubules of small juvenile to mature masu salmon at all seasons, but *Myxidium* sp. in the renal tubules only in summer at water temperatures over 15°C. The sporozoan parasites were found in white spotted char with high prevalence and in rainbow trout with low prevalence, but not in coho and chum salmon. Another species of haplosporidia-like organisms and *Myxidium* were found in the renal tubules and ureters of pink salmon. (Authors). (Paper in Japanese).

002196.

000008

Bailey, T. A.

1983. Method for in vitro screening of aquatic fungicides. J. Fish Dis. 6(2):91-100. (U. S. Fish Wildl. Serv. Natl. Fish. Res. Lab. P. O. Box 818, La Crosse, Wis. 54601.).

Methods were developed for screening fungicides for efficacy against *Achlya flagellata*, *A. racemosa*, *Saprolegnia hypogyna*, and *S. megasperma*. Agar plugs containing fungal hyphae, were placed in spot plates containing 1.0, 10.0 and 100 mg/L of the candidate compounds for 15 or 60 min. After exposure, the plugs were transferred on to filter papers, rinsed, and then placed on cornmeal agar medium. The plates were checked for mycelial growth after 48, 96 and 168 h in a lighted chamber at 20°plus-minus°2°C. Criteria for the acceptance or rejection of fungicides were based on the antifungal spectrum index (ASI) comparisons between respective compounds and malachite green after 48 h and the concentration level producing complete growth inhibition. Candidate compounds

whose ASI was less than 50% that of malachite green after 48 h or did not inhibit growth at levels less than 100 mg/L were rejected. (Authors).

002187.

000009

Bailey, T. A.

1983. Screening fungicides for use in fish culture: evaluation of the agar plug transfer, cellophane transfer, and agar dilution methods. Prog. Fish-Cult. 45(1):24-27. (U.S. Fish Wildl. Serv. Natl. Fish. Res. Lab. P.O. Box 818, La Crosse, Wis. 54601.).

The reliablity, reproducibility, and usefulness of three screening methods – the cellophane transfer, the agar plug transfer, and the agar dilution – to screen aquatic fungicides were evaluated. *Achlya flagellata* and *Saprolegnia hypogyna* were exposed to 1, 10, and 100 mg/L of malachite green to test each method. The cellophane transfer and agar plug transfer techniques had similar reliability and reproducibility in rating fungicidal activity, and both were superior to the agar dilution technique. The agar plug transfer and agar dilution techniqes adequately projected in vivo activity of malachite green, but the cellophane transfer technique overestimated its activity. Overall, the agar plug transfer technique most accurately rated the activity of malachite green and was the easiest test to perform. It therefore appears to be the method of choice for testing aquatic fungicides. (Author).

002240.

000010

Ball, S. J.

1983. *Eimeria metchnikovi* (Laveran, 1987) Reichenow, 1921 from the gudgeon, *Gobio gobio* L. in south-east England. J. Fish Dis. 6(2):201-203. (Dep. Biol. North East London Polytech. Romford Road, London E15 4LZ, England.).

Sporulated oocysts were found in the spleen of 3 of 291 gudgeons from one stream and 2 of 10 from another. The report is the first of the parasite in the U.K. The organism is described and illustrated and compared with other coccidia. (Ken Wolf).

002193.

000011

Beverly-Burton, M., Margolis, L.

1982. *Ophioxenos lampetrae* sp. nov. (Digenea: Paramphistomidae) from ammocoetes of the western brook lamprey (*Lampetra richardsoni* Vladykov and Follett) in British Columbia, with comments on lamprey host-parasite relationships. Can. J. Zool. 60(10):2514-2520. (Dep. Zool. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

Ophioxenos lampetrae sp. nov. (Digenea: Paramphistomidae) from the intestine of ammocoetes of the western brook lamprey (*Lampetra richardsoni*) in British Columbia, Canada, is described. This appears to be the first record of a digenean utilizing a petromyzontid as a definitive host. Some aspects of lamprey host-parasite relationships are discussed. (Authors).

002184.

000012

Boomker, J.

1982. Parasites of South African freshwater fish. I. Some nematodes of the catfish (*Clarias gariepinus* 'Burchell, 1822@) from the Hartbeespoort Dam. Onderstepoort J. Vet. Res. 49(1):41-51. (Dep. Parasitol. Fac. Vet. Sci. Univ. Pretoria, P.O. Box 12580, Onderstepoort, 0110, South Africa.).

A seasonal study of the parasites of fish in the Hartbeespoort Dam was undertaken in 1979. This paper deals with four nematode species recovered from catfish, namely *Paracamallanus cyathopharynx* (Baylis, 1923), *Procamallanus laeviconchus* (Wedl, 1862), *Contracaecum* sp. and *Skrjabinocara* sp. (Author).

002211.

000013

Bullock, G. L., Maestrone, G., Starliper, C., Schill, B.

1983. Furunculosis: results of field trials for therapy with Ro5-0037, a potentiated sulfonamide. Prog. Fish-Cult. 45(1):51-53. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

In 8 of 10 field trials, treatment with a potentiated sulfonamide, Ro5-0037 (5 parts sulfadimethoxine and 1 part ormetoprim) at 50 mg/kg of fish

per day for 5 days provided control of furunculosis. (Authors).

002265.

000014

Burreson, E. M.

1982. The life cycle of *Trypanoplasma bullocki* (Zoomastigophorea: Kinetoplastida). J. Protozool. 29(1):72-77. (Virginia Inst. Mar. Sci. Sch. Mar. Sci. Coll. William Mary, Gloucester Point, Va. 23062.).

The leech *Calliobdella vivida* (Verrill) is the vector of *Trypanoplasma bullocki*. At 10°C, infective-stage flagellates were first present in the leech's proboscis sheath 5 days after feeding. At 5°C, infective-stage flagellates were not present in the leech's proboscis sheath until 10 days after feeding, but at 20°C, flagellates were located there as early as 24 h after feeding. When flagellates were first observed in hogchoker, *Trinectes maculatus* (Bloch and Schneider), they were much larger than infective stages from the leech. Peak parasitemia was greater in a hogchoker inoculated by only one leech but held at colder temperature than in a hogchoker inoculated by 45 leeches. Cell division in the fish host is described. SEM studies of fish blood flagellates revealed a pre-oral ridge and a cytostome. (Author).

002262.

000015

Camp, J. W., Aho, J. M., Esch, G. W.

1982. A long-term study on various aspects of the population biology of *Ornithodiplostomum ptychocheilus* in a South Carolina cooling reservoir. J. Parasitol. 68(4):709-718. (Dep. Biol. Wake Forest Univ. Winston-Salem, N. C. 27109.).

The population biology of *Ornithodiplostomum ptychocheilus* was examined in mosquitofish, *Gambusia affinis*, within ambient temperature and thermally altered locations of a South Carolina cooling reservoir. During the 53-month study period, both prevalence and mean density of metacercariae fluctuated erratically in mosquitofish from ambient areas. In heated parts of the reservoir, seasonal changes were also unpredictable although there was a tendency to be highest in spring and decline in late summer and early fall. (Authors).

002227.

000016

Chervinski, J.

1982. A note on the effects of low temperature on golden grey mullet *Liza aurata* (Risso) maintained in sea-water ponds. Bamidgeh 34(1):33-35. (Fish Aquacult. Res. Stn. Dor, Israel.).

Mortality occurred in young mullet only when temperature dropped below 9°C. Sea water concentrations of 100% and 50% did not affect the rate of survival. (Ken Wolf).

002199.

000017

Csaba, G., Kovacs-Gayer, E., Bekesi, L., Tuboly, S., Banki, M. Kormendi, B.

1982. Mycobacteriosis of fish. II. Mass infection of a stock of *Macropodus opercularis*. (Mykobakteriose der Fische. II Massenerkrankung in einer *Macropodus opercularis* Zucht.) Riv. Ital. Piscic. Ittiop. 17(2):84-87. (Veterinarmed. Zentralinst. Budapest, Hungary.).

Clinical, pathological and histopathological description is given of a mycobacterial infection in a stock of *Macropodus* maintained for genetic experiments. (R. L. Herman). (Paper in German).

002195.

000018

Cupp, J. K., Willis, D. W.

1982. Occurrence of the mite *Lebertia* in a green sunfish (*Lepomis cyanellus*). J. Parasitol. 68(5):876. (Dep. Biol. Pittsburg State Univ. Pittsburg, Kans. 66762.).

Case report of an infrequently encountered parasite. (Ken Wolf).

002170.

000019

Davies, A. J.

1982. Further studies on *Haemogregarina bigemina* Laveran & Mesnil, the marine fish *Blennius pholis* L. and the isopod *Gnathia maxillaris* Montagu. J. Protozool. 29(4):576-583. (Dep. Zool. Univ. Coll. Wales, Aberystwyth, SY23 3DA, Wales, England.).

Haemogregarina bigemina is redescribed from the blood of the marine fish *Blennius pholis*, and stages presumed to be those of the hemogregarine are recorded from the hematophagous praniza larva of the isopod *Gnathia maxillaris*. No exoerythrocytic stages were observed in these fish, nor was sexual dimorphism of the gametocyte evident. As in an earlier study, ecological evidence favored transmission by *G. maxillaris* rather than by leeches. Gametocytes, syzygy, oocysts, sporoblasts, and sporozoites were identified in the anterior hindgut of the isopod. The stages observed in *G. maxillaris* are compared with those of other hemogregarines described from the digestive tract of leeches. Mention is made of an intraleucocytic hemogregarine of another fish, *Crenilabrus melops*. (Authors).

002172.

000020

Despres-Patanjo, L., Ziskowski, J., Murchelano, R. A.

1982. Distribution of fish diseases monitored on stock assessment cruises in the western north Atlantic. Int. Counc. Explor. Sea C.M. 1982/E:30:1-12. (Northeast Fish. Cent. Woods Hole Lab. Woods Hole, Mass. 02543.).

This paper summarizes and geographically presents the distribution of integumental ulcers, fin rot, lymphocystis, skeletal anomalies and ambicoloration in fishes examined on bottom fish assessment surveys conducted from Cape Hatteras to Nova Scotia. With the possible exception of fin rot and lymphocystis, the diseases noted appeared to be randomly distributed in the survey area. Overall disease prevalence in 105,042 fishes was 0.99%. (Authors).

002250.

000021

Doller, G., Enzmann, P-J.

1982. Induction of baculovirus specific antibodies in rainbow trout and carp. Bull. Eur. Assoc. Fish Pathol. 2(4):53-55. (Fed. Res. Inst. Anim. Virus Dis. POB 1149, D-7400 Tubingen, Fed. Rep. Germany.).

Near-yearling fish were injected intraperitoneally and later boosted with preparations of insect viruses: polyhedrin (a matrix protein) of nuclear polyhedrosis virus from larvae of a noctuid lepidopteran, or granulin (also a matrix protein) of granulosis virus from larvae of a tortricid lepidopteran. When assayed in gel diffusion test 6 weeks after the first injection, both carp and trout showed an antibody response to antigens. Authors claim that the work provides a basis for safety studies of the viral insecticides. (Ken Wolf).

002181.

000022

Dorson, M.

1982. Infectious pancreatic necrosis of salmonids: present status of knowledge concerning the viruses and the possibilities of controlling the disease. (Necrose Pancreatique Infectieuse des Salmonides; Etat des Connaissances Concernant les Virus et les Possibilites de Lutte Contre la Maladie.) Bull. Fr. Piscic. 285(2):195-209. (Lab. Ichthyopathol. INRA, Route de Thiverval, 78850 Thiverval-Grignon, France.).

This paper reviews the state of knowledge concerning IPN virus, the factors influencing on mortalities caused by the disease and vaccination, and stresses the points which are relevant from a practical viewpoint. Infectious pancreatic necrosis viruses and related viruses display a variety which is growing as new strains are studied: this variety lies on biological as well as antigenic properties and is complicated by the easy in vitro selection of variants differing from stem virus. It is becoming more and more difficult to place viruses isolated from the field in classical serotypes. The epidemiology, especially carrier state and transmission of virus, has received a special attention due to the importance of the problem in France. Rainbow trout eliminates the virus much better than brook trout, and it appears that vertical transmission does not occur automatically. Vertical transmission must be achieved through different ways, and in some cases it can be avoided by egg disinfection. The severity of the disease is lowered at temperatures above 15°C, and the period during which fry is susceptible to the disease can be expressed in

day × degrees. Interference between IPN and viral hemorrhagic septicemia is pointed out. (Author). (Paper in French).

002219.

000023

Durve, V. S., Lovell, R. T.

1982. Vitamin C and disease resistance in channel catfish (*Ictalurus punctatus*). Can. J. Fish. Aquat. Sci. 39(7):948-951. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36849.).

Channel catfish (*Ictalurus punctatus*) fingerlings were fed semipurified diets containing 0-150 mg/kg of vitamin C for 14 weeks and subsequently at two temperature regimes infected with the pathogenic bacterium *Edwardsiella tarda*. Mortality rates were determined 96 h after infection. A supplemental vitamin C level of 30 mg/kg of diet was sufficient for normal growth and for prevention of deficiency signs such as lordosis, scoliosis, and a reduction in bone collagen formation. However, increased resistance against infection was provided when the level of supplemental vitamin C was increased to the highest dietary level, 150 mg/kg, at a water temperature of 23°C. At 33°C, increasing the supplemental level of vitamin C had significantly less effect on resistance against infection. The difference in response at the two temperatures indicates that the vitamin C requirement for resistance to infection is possibly higher when channel catfish are infected at lower temperatures, where the natural resistance is reduced, than when infected at a temperature near optimum for the natural resistance mechanisms of the fish. (Authors).

002210.

000024

Ewing, M. S., Ewing, S. A., Zimmer, M. A.

1982. Sublethal copper stress and susceptibility of channel catfish to experimental infections with *Ichthyophthirius multifiliis*. Bull. Environ. Contam. Toxicol. 28(6):674-681. (Dep. Zool. Oklahoma State Univ. Stillwater, Okla. 74078.).

Within the sublethal range of measured concentrations <25 to 1030 μg dissolved copper per liter, a weak though statistically significant positive correlation existed between exposure concentration and susceptibility to the parasite. Fish exposed to measured concentrations of less than 25 μg/liter had mean infections of 30 trophozoites/cm² skin and fish exposed to 280 to 1030 μg/liter had mean infections of 39 trophozoites/cm². It appears that the pathologic changes attendant upon exposure to the parasite and those upon exposure to copper are complementary in effect. (Authors).

002247.

000025

Fischthal, J. H., Carson, D. O., Vaught, R. S.

1982. Comparative size allometry of the digenetic trematode *Lissorchis attenuatus* (Monorchiidae) at four intensities of infection in the white sucker. J. Parasitol. 68(2):314-318. (Dep. Biol. Sci. State Univ. New York at Binghamton, Binghamton, N. Y. 13901.).

Allometric growth was compared for the digenetic trematode *Lissorchis attenuatus* at four intensities of infection in the white sucker, *Catostomus commersoni*. Significant differences in allometric growth of the trematode were found. Results are given. (Authors).

002258.

000026

Fukuda, Y., Kusuda, R.

1982. Purification and characterization of yellowtail immunoglobulin. Bull. Jpn. Soc. Sci. Fish. 48(7):921-926. (Oita Prefect. Fish. Exp. Stn. Kamiura, Minami-Amabe, Oita 879-26, Japan.).

In order to elucidate the immuno-system of yellowtail *Seriola quinqueradiata* against pseudotuberculosis, attempts were made to purify and characterize its immunoglobulin. Yellowtail sera, which produced an agglutinating antibody in high titer against the causative agent of pseudotuberculosis, *Pasteurella piscicida*, were used. Immunoglobulin was purified from the sera by the procedures which involved gel filtration on Sepharose 6B and ion exchange chromatography on DEAE-Sephadex A-25. Yellowtail immunoglobulin thus purified was found to be a macroglobulin having the electrophoretic mobility of β-globulin in agar gel immunoelectrophoresis. Yellowtail immunoglobulin showed a higher agglutinating antibody activity at 20-25°C than at 37°C. The immunoglobulin was dissociated into subunits when subjected to partial reduction with dithiothreitol and alkylation. The subunit had no agglutinating antibody activity

against *P. piscicida* cells. (Authors). (Paper in Japanese).

002177.

000027

Giorgetti, G.

1982. Present situation of saddleback disease in Italy. Bull. Eur. Assoc. Fish. Pathol. 2(4):58-59. (Inst. Zooprofilattico Venezie, Lab. Ittiopatol. Via della Roggia 70, 33030 Basaldella di Campoformido (Udine), Italy.).

The disease afflicts rainbow trout fry and fingerlings, and mortality can reach 50%. Sunlight is a major factor, but a mild form of the disease occurs in closed sheds. Flexibacteria are always found in the lesions. Prophylaxis consists of providing shade, stocking at low density, oral administration of oxytetracycline (70 mg/kg, frequency not given), or baths with malachite green or copper sulfate. (Ken Wolf).

002179.

000028

Goldstein, R. J.

1982. Your fishes' health: roundworms. Tropical Fish Hobbyist 31(1, 319):44-46. (T.F.H. Publ. 211 W. Sylvania Ave. Neptune City, N. J. 07753.).

A popular article written for the hobbyist. (Ken Wolf).

002209.

000029

Gratzek, J. B., Gilbert, J. P., Lohr, A. L., Shotts, E. B. Jr. Brown, J.

1983. Ultraviolet light control of *Ichthyophthirius multifiliis* Fouquet in a closed fish culture recirculation system. J. Fish Dis. 6(2):145-153. (Dep. Med. Microbiol. Coll. Vet. Med. Univ. Georgia, Athens, Ga. 30602.).

A closed fish culture recirculation system consisting of 36 20-gallon aquaria in series with a rotating plate biofilter, a diatomaceous earth filter, and an ultraviolet (UV) light sterilizer was evaluated for the effectiveness of UV light in preventing spread of *Ichthyophthirius multifiliis*. Water from the aquaria, the reservoir, and a valve 29 cm beyond the UV light source was analyzed bacteriologically to assess its effectiveness. The spread of *I. multifiliis* from one aquarium to another was controlled with 91,900 μW s/cm^2 of UV light. No significant differences in the bacterial counts from the water of the reservoir or the aquaria could be demonstrated when the UV light was either on or off, although a significant difference could be demonstrated between the sterilizer effluent and the reservoir and aquaria. (Authors).

002194.

000030

Grizzle, J. M., Williams, E. H. Jr.

1983. Dermal fibroma in a redband parrotfish, *Sparisoma aurofrenatum* (Valenciennes). J. Fish Dis. 6(2):205-209. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36849.).

The tumor was found on only one fish and was composed of random bundles of fibrous tissue in which cells were spindle-shaped, had elongate nuclei and cytoplasmic processes. Mitoses were scarce and no metastases were found. The report is illustrated and sections have been deposited with the Registry of Tumors of Lower Animals, Smithsonian Inst. Washington, D.C. (RTLA 2492). (Ken Wolf).

002192.

000031

Guest, W. C.

1983. Control of *Ichthyophthirius* in peacock bass fingerlings. Prog. Fish-Cult. 45(1):57. (Ft. Worth Res. Unit, Texas Parks Wildl. Dep. 6200 Hatchery Road, Ft. Worth, Tex. 76114.).

Fingerling, but not adult, *Cichla ocellaris* were stressed and eventually died after prolonged exposure to 0.1 mg/L malachite green and 25 mg/L formalin. The formalin concentration alone was tolerated as were reduced levels of malachite green. A mixture of 0.05 mg/L malachite green and 25 mg/L formalin is suggested for control. Several treatments might be required. (Ken Wolf).

002266.

000032

Hashimoto, S.

1982. Studies on the metabolic functions of young chum salmon, *Oncorhynchus keta* (Walbaum) – III. Effect of deletion of vitamin C and K from and addition of water to manufactured diet. Sci. Rep. Hokkaido Salmon Hatchery 36:39-47. (Hokkaido Salmon Hatchery, 2-2, Nakanoshima, Toyohiraku, Sapporo, Hokkaido, Japan.).

Sufficient dietary water to fingerlings seems to prevent physiological troubles caused by artificial diets. Chum fingerlings seem to like soft and watery diets. However, the soft diet with full moisture pollutes the rearing environment, encouraging the occurrence of diseases, and lowers the survival rate when fingerlings go to sea. Deletion of vitamin K apparently had no effect on hematocrit values. (Author). (Paper in Japanese).

002221.

000033

Hayashi, F., Araki, Y., Harada, K., Inoue, M., Mitsuhashi, S.

1982. Epidemiological studies of drug resistant strains in cultured fish and water. Bull. Jpn. Soc. Sci. Fish. 48(8):1121-1127. (Gunma Prefect. Fish. Exp. Stn. 13 Shikishima, Maebashi 371, Japan.).

Various species of bacteria have been isolated from cultured fish; the *Aeromonas* group, in particular, was found most frequently in all the fish examined, followed by *Flavobacterium* and *Pseudomonas*. Resistance patterns of R plasmids from drug resistant organisms were often observed resistance to (TC. CM. SM. SA), (CM. SM. SA), (TC. SM. SA) and (TC. SA). R plasmids encoding resistance to (TC. SA), (SA) and (CM. SM. SA) are characteristic of bacteria in fish. We also found a high frequency of nonconjugative drug resistant plasmids from drug resistant strains. These plasmids were mobilized in the presence of conjugative plasmids at a high frequency. (Authors). (Paper in Japanese).

002185.

000034

Heggberget, T. G., Johnsen, B. O.

1982. Infestations by *Gyrodactylus* sp. of Atlantic salmon, *Salmo salar* L. in Norwegian rivers. J. Fish Biol. 21(1):15-26. (Dir. Wildl. Freshw. Fish, Elgestergt. 10, 7000 Trondheim, Norway.).

Young Atlantic salmon, brown trout, and Arctic char from eight rivers were examined. A *Gyrodactylus salaris* type was observed infecting salmon from six of these rivers. No trout or char were infected. A high frequency and intensity of infection of salmon were observed in all but one of the rivers surveyed. In the Saltdalselva, only one specimen of *Gyrodactylus* infecting one fish was observed. No subsequent mortality of salmon was observed in this river while there were signs of a high mortality of salmon in the other rivers. The salmon parr were more frequently attacked than the fry, the mortality of salmon seemed to have happened in most of the rivers one year after the first observations of *Gyrodactylus* were made. The mortality of salmon and the high infection rate of *Gyrodactylus* in these rivers appears unique, and as far as known to the authors there are no other described cases of mortality due to *Gyrodactylus* in Atlantic salmon in natural waters. Other possible causes of mortality were not investigated. (Authors).

002198.

000035

Hille, S.

1982. A literature review of the blood chemistry of rainbow trout, *Salmo gairdneri* Rich. J. Fish Biol. 20(5):535-569. (Inst. Seenforsch. Fisch. Langenargen, Fed. Rep. Germany.).

The literature on the blood chemistry of rainbow trout, *Salmo gairdneri* Rich. is reviewed from the aspects of experimental methods, electrophoresis, normal values, environmental and endogenous factors including toxic substances and diseases. (Author).

002233.

000036

Huey, D. W., Beitinger, T. L.

1982. A methemoglobin reductase system in channel catfish *Ictalurus punctatus*. Can. J. Zool. 60(6):1511-1513. (Dep. Biol. Sci. Inst. Appl. Sci. North Texas State Univ. Denton, Tex. 76203.).

A modified spot screening test for methemoglobin reductase (MHb reductase), indicated that this enzyme occurs in channel catfish, *Ictalurus punc-*

tatus. The presence of MHb reductase offers at least a partial explanation of the rapid recovery observed when catfish with profound nitrite-induced methemoglobinemia are placed in nitrite-free water. (Authors).

002244.

000037

Ibrahim, K. H., Gupta, S. D., Sen, P. R.

1982. Malformation of the vertebral column in single spawn progeny of *Labeo rohita* (Hamilton). Bamidgeh 34(2):59-62. (Cent. Inland Fish. Sub-Stn. Cuttack, Orissa, India.).

A large number of phenotypic deviants has been recorded in a single spawn brood of *Labeo rohita* (Ham.). The deformed specimens showed poor growth and viability. Malformation of the vertebral column was manifested as vertebral fusion, splitting of neural and hemal spines, and curvature of the entire vertebral column. In 10.9% of the progeny there was externally visible malformation, whereas, among the apparently normal specimens, 50% revealed internal vertebral malformations. Inbreeding and adverse environmental factors are considered the putative factors effecting the large-scale malformations. The need to maintain separate pedigrees and prevent close inbreeding in the production of high quality fish seed is emphasized. (Authors).

002173.

000038

Iida, T., Wakabayashi, H., Egusa, S.

1982. Vaccination for control of streptococcal disease in cultured yellowtail. Fish Pathol. 16(4):201-206. (Dep. Fish. Fac. Agric. Univ. Tokyo, Bunkyo-ku, Tokyo, Japan.).

Efficacy of oral vaccination for control of streptococcal disease in cultured yellowtail was studied. The bacterin, the formalin-killed cells of *Streptococcus* sp. as the etiological agent of this disease, was used. This bacterin was administrated 1, 2, 4, 8, 16 times at a level of 5 mg dry weight per fish per day, and 8, 12 times at a level of 20 mg wet weight per fish per day. About a week after the last vaccination, fish were challenged for the estimate of efficacy of oral vaccination. Duration of oral vaccination effect was also tested. Dry bacterin was fed 2, 4, 8 times, and about 1, 2, 3, 4 weeks after the first vaccination, fish were challenged for the estimate of oral vaccination effect. Both dry and wet bacterin were effective, and the efficacy became more active with an increase in frequency of oral vaccination. But antibody in the blood was not detected. Duration of oral vaccination effect was very short. That effect was prolonged for only 2 weeks after the last vaccination. In order to compare with oral vaccination, efficacies of hyperosmotic infiltration and intraperitoneal injection for control of this disease were also studied. Hyperosmotic infiltration was more effective than oral vaccination. Intraperitoneal injection was the best method of three experimented. (Authors). (Paper in Japanese).

002230.

000039

Ikeda, K.

1981. Gel chromatography of anti-*Aeromonas salmonicida* agglutinating antibody of chum salmon raised in freshwater. Bull. Natl. Res. Inst. Aquacult. 2:83-86. (Natl. Res. Inst. Aquacult. 224-1, Hiruta, Tamaki-cho, Watarai-gun, Mie-ken, 519-04, Japan.).

Chum salmon (*Oncorhynchus keta*) raised in freshwater for 16 months were immunized by a single intraperitoneal injection of formalinized *Aeromonas salmonicida*. After 4 weeks, blood was taken from immunized chum salmon and the antiserum was fractionated by column chromatography on Sephadex G-200, Sepharose 6 B and Sepharose 4 B. Each fraction was measured at an optical density of 280 nm, and assayed for antibody activity. The agglutinin activity was found in void volume on Sephadex G-200, in Kav = 0.3 on Sepharose 6 B and in Kav = 0.4 *approx* 0.5 on Sepharose 4 B, respectively. These results show that anti-*A. salmonicida* chum salmon agglutinin was high molecular weight antibody similar to human IgM. A low molecular weight antibody was not detected. (Author). (Paper in Japanese).

002252.

000040

Ikeda, Y.

1982. The variation of serum constituent levels on the time placed to clot after blood sampling in carp. Bull. Jpn. Soc. Sci. Fish. 48(7):877-881. (Tokyo Univ. Fish. 5-7, Konan 4, Minato, Tokyo 108, Japan.).

As a fundamental step to settle the hemochemical assessment of health or disease in fish, the variation of serum constituent levels on the time

placed to clot was investigated in carp *Cyprinus carpio*. The blood collected by heart puncture was placed in three tubes, and centrifuged after keeping for 1, 3 and 6 h at 30°C. Serum glucose level decreased with the lapse of time. The range of 6 h values was from 25 to 91% of 1 h value. In contrast, serum levels of both magnesium and inorganic phosphorus increased. The range of the former was from 109 to 273%, and that of the latter was from 114 to 489% except in one sample. These rates varied with season. It was guessed that the occasional variations of serum activities or levels of GOT, LDH, A1-P, calcium and total protein may be the result of the collapse of thrombocyte. Serum GPT activity and chloride level did not change. From the above results, it is desirable to obtain the serum as soon as possible after blood sampling to get a trustworthy value. (Author). (Paper in Japanese).

002176.

000041

Jo, Y.

1982. Streptococcal infections of cultured freshwater fishes. Fish Pathol. 17(1):33-37. (Tokushima Pref. Fish. Exp. Stn. Hiwasa, Tokushima, Japan.).

Recently, streptococcal infections have been frequently observed in freshwater fishes, especially in ayu, *Plecoglossus altivelis*, cultured in Tokushima Prefecture. The first outbreak was observed in 1977. Since then, epizootics have occured among ayu in summer and autumn every year, and cause serious economic losses. The present paper deals with occurrence, diagnostics and clinical studies of the disease. (Authors). (Paper in Japanese).

002254.

000042

Jowko, G., Korwin-Kossakowski, M., Jezierska, B.

1981. The effect of selected environmental factors on carp *Cyprinus carpio* L. larvae. (Wplyw wybranych czynnikow srodowiska na larwy karpia (*Cyprinus carpio* L.).) Rocz. Nauk Roln. Ser. H. Rybactwo 99(4):25-37. (Agric. Sch. Siedlce, Inst. Appl. Biol. Dir. Inst: doc. dr hab. Danuta Tyrawska-Spychalowa, Poland.).

The study defines the influence of various temperatures 20, 22, 28, 32°C and hunger on carp larvae (*Cyprinus carpio* L.). It was found that temperature influences survival and the rate of postembryonal development of larvae, as also their metabolism determined by defining oxygen utilization and the respiratory coefficient *RQ*. Highest mortality was observed at all of the temperatures during the period of converting to exogenous feeding, depending upon the temperature, from 6 to 15 days after hatching. Larvae which were starved survived only up to around the 10-13 day. Temperatures of 28 and 32°C were found to be too high, and resulted in almost total mortality of hatchings within a short time, whereas survival of larvae at a temperature of 22°C remained at a range of around 60-70%. (Authors). (Paper in Polish).

002168.

000043

Kano, T., Fukui, H.

1982. Studies on *Pleistophora* infection in eel, *Anguilla japonica*–I. Experimental induction of microsporidiosis and fumagillin efficacy. Fish Pathol. 16(4):193-200. (Takeda Chem. Ind. Ltd. Res. Dev. Dep. Anim. Health Prod. Div. Osaka, Japan.).

Experimental infection was tried by inoculating orally *Pleistophora* spores into juvenile eels or immersing them in water suspension of the fresh spores. Both methods were successful in inducing the same symptom as that of naturally-occurring diseased fish. Early schizonts, cysts in the trunk muscle, and whitish lesions on the body surface were observed around 10, 20, and 25 days after inoculation, respectively. In oral infection, the whitish lesions developed mainly on the body surface around the abdomen. In the immersing infection, on the other hand, they were scattered over the whole body. These results and the histological investigations suggest that the parasite at early stages reaches the musculature via the gut wall and peritoneal fluid in oral infection, and via the skin in immersion, rather than via the blood vascular system. From another experiment, it was found that *Pleistophora* infection was very weak at low temperature such as 14°C. Fumagillin was found to have prophylactic effect on these experimental infections by oral or immersed administration immediately after inoculation. (Authors). (Paper in Japanese).

002231.

000044

Katae, H.

1982. Erythromycin–the application to streptococcal infections in yellowtails. Fish Pathol. 17(1):77-85. (Dainippon Pharm. Co. Ltd. Res. Lab. 25 Doshomachi 3-chome, Higashi-ku, Osaka, 541 Japan.).

Application of erythromycin (EM) to spontaneous streptococcal infections in cultured yellowtails, *Seriola quinqueradiata*, is reviewed. In vitro, EM was active against a wide range of bacteria pathogenic for fish. Stock strains and fresh field isolates of *Streptococcus* sp. were susceptible to EM whose MIC values varied from 0.05 to 0.2 μg per mL. There were no resistant streptococcal strains so far tested. The MIC of EM was slightly affected by inoculum size and pH. In vivo, orally administered EM was effective against experimental infections with *Streptococcus* sp. in yellowtails. It was easily absorbed by oral administration and distributed to blood and tissues including brain within 1 h after administration. Peak levels were usually attained 1 to 3 h postadministration. Acute toxicity of EM was low in yellowtails, its LD_{50} value being more than 2000 mg/kg. Abnormality possibly caused by EM was not found in yellowtails receiving the repeated doses of the drug at a dose of 100 mg/kg per day for 10 days. In the clinical studies, EM was effective against streptococcal infections in cultured yellowtails at doses of 25-50 mg/kg per day for 4-7 days. (Author). (Paper in Japanese).

002224.

000045

Kimura, I., Morikawa, S., Kiriyama, T., Kitaori, H.

1983. An epizootic occurrence of rhabdomyoma and a case of ganglioneuroma in hatchery-reared ayu, *Plecoglossus altivelis* Temminck & Schlegel. J. Fish Dis. 6(2):195-200. (Lab. Viral Oncol. Aichi Cancer Cen. Res. Inst. Tashiro-cho, Chikusa-ku, Nagoya, Japan.).

Rhabdomyomas were found at incidences of 0.5 to 1.5% in two of 47 ponds examined. Illustrations are provided of gross lesions, and of histologic sections. A single ganglioneuroma was found, and micrographs of sections are similarly provided. The tumors did not metastasize, and electronnicrographs of several rhabdomyomas failed to reveal virus-like particles. (Ken Wolf).

002191.

000046

Kitao, T.

1982. The methods for detection of *Streptococcus* sp. causative bacteria of streptococcal disease of cultured yellowtail (*Seriola quinqueradiata*). Fish Pathol. 17(1):17-26. (Lab. Microbiol. Fac. Agric. Miyazaki Univ. Miyazaki, Japan.).

Comparative cultural, biochemical and serological properties of 286 strains of *Streptococcus* sp. isolated from streptococcal disease of cultured yellowtail (*Seriola quinqueradiata*) were studied. Although some cultural characteristics of *Streptococcus* sp. are most similar to those of *S. faecalis* and *S. faecium*, ●i*Streptococcus* sp. do not react with group D streptocccus antiserum. *Streptococcus* sp. were presumptively identified by bile-esculin medium (growth in 40% bile and hydrolyze esculin), eosin-methylene blue medium (no ferment lactose), a modified NaCl medium by Qadri (no color change) and the rapid hippurate hydrolysis test by Hwang (negative reaction), and in addition, accurately identified by the slide agglutination using *Streptococcus* sp. antiserum prepared with *Streptococcus* sp. KG-type strain. Besides, *Streptococcus* sp. could be detected in pure and a high frequency from brain rather than other organs of diseased fish in our own past experience. (Author). (Paper in Japanese).

002260.

000047

Kitao, T., Aoki, T., Fukudome, M., Kawano, K., Wada, Y., Mizuno, Y.

1983. Serotyping of *Vibrio anguillarum* isolated from diseased freshwater fish in Japan. J. Fish Dis. 6(2):175-181. (Dep. Fish. Fac. Agric. Miyazaki Univ. Miyazaki 880, Japan.).

During the period from 1965 to 1980, 263 *V. anguillarum* strains from ayu, two from rainbow trout, and two from eel, were collected. On the basis of cross-agglutination and cross-absorption tests with thermostable (O) antigens, distinct serotypes A, B, C, D, E and F were established. 241 strains isolated from ayu and two strains from rainbow trout belonged to serotype A, six strains from ayu and one strain from eel to serotype B, 12 strains from ayu to serotype C, three strains from ayu to serotype D, one strain from ayu to serotype E, and one strain from eel to serotype F. *V. anguillarum* strains belonging to serotypes D, E and F have not been detected from ayu, rainbow trout and eel since 1973; these serotypes appear to be minor types. *V. anguillarum* strain NCMB 6 and

1669 belong to our serotype A and *V. anguillarum* 813 to our serotype C. (Authors).

002190.

000048

Kusuda, R., Kawai, K.

1982. Characteristics of *Streptococcus* sp. pathogenic to yellowtail. Fish Pathol. 17(1):11-16. (Fish Dis. Lab. Fac. Agric. Kochi Univ. Nankoku, Kochi 783, Japan.).

Growth occurred at a range (optimum) of 10-45°C (20-37°C), 0-7●)vi (0%) of NaCl concentration and pH 3.5-10.0 (7.6). Prolonged survivability was observed in seawater especially ●iin the seawater obtained from pen-culturing area resulting for 42 days at 25°C. Pathogenic *Streptococcus* was detected in seawater, bottom mud and the intestine of fish such as chub mackerel *Scomber japonicus* and black scraper *Navodon modestus*.

Isolation could be easily performed from the kidney, the spleen and the intestine of the infected fish. From the reason that a large number of cells were detected in the intestine of moribund fish, this organ was considered to be the principal site for the progress of the infection. Endotoxin produced by *Streptococcus* showed lethal activity at a level that LD_{50} was 32 mg per 10 g body weight of fish. Though exotoin also produced by *Streptococcus* had relatively low lethal activity that LD_{50} was 79 mg per 10 g, it was considered to have a supporting function to progress the disease. (Authors). (Paper in Japanese).

002259.

000049

Lacey, S. M., Williams, I. C., Carpenter, A. C.

1982. A note on the occurrence of the digenetic trematode *Sphaerostoma bramae* (Muller) in the intestine of the European eel, *Anguilla anguilla* (L.). J. Fish Biol. 20(5):593-596. (Dep. Zool. Univ. Hull, North Humberside, HU6 7RX, England.).

The allocreadiid digenean *Sphaerostoma bramae* (Muller) was found in three of 602 eels, *Anguilla anguilla* (L.), caught over a period of 25 months from drains and rivers in the lower River Trent drainage area. Eleven, 15, and 32 specimens of *S. bramae* were found in the posterior 40% of the respective host's intestine. Concurrent infestations with *Protocephalus macrocephalus*, *Acanthocephalus clavula* and *Rhaphidascaris acus* were observed. The results are discussed in relation to the helminthology and ecology of the eel. (Authors).

002234.

000050

Lawler, A. R.

1979. North American fishes reported as hosts of *Amyloodinium ocellatum* (Brown, 1931). Drum Croaker 19(1):8-14. (Gulf Coast Res. Lab. Ocean Springs, Miss. 39564.).

Tabular data include 111 species of 46 families of susceptible fishes. (Ken Wolf).

002215.

000051

Lawler, A. R.

1977. The parasitic dinoflagellate *Amyloodinium ocellatum* in marine aquaria. Drum Croaker 17(2):17-20. (Gulf Coast Res. Lab. Ocean Springs, Miss. 39564.).

A brief but worthwhile review of the parasite life cycle, behavior of afflicted hosts, methods of diagnosis, and control. (Ken Wolf).

002216.

000052

Lawler, A. R.

1978. *Trichodinella lawleri* Lom and Haldar, 1977, causing deaths of pinfish in aquaria. Drum Croaker 18(2):1-3. (Gulf Coast Res. Lab. Ocean Springs, Miss. 39564.).

Case report of the discovery of a new trichodinid. Tabular data on possible chemical methods of control are given–but were not tried. (Ken Wolf).

002217.

000053

Lawler, A. R., Cave, R. N.

1978. Deaths of aquarium-held fishes caused by monogenetic trematodes. I. *Aspinatrium pogon-*

iae (MacCallum, 1913) on *Pogonias cromis* (Linnaeus). Drum Croaker 18(1):31-33. (Gulf Coast Res. Lab. Ocean Springs, Miss. 39564.).

A case report and first in a series of papers concerning deaths of aquarium-held fishes caused by monogenetic trematodes. (Authors).

002214.

000054

Lobb, C. J., Clem, L. W.

1982. Fish lymphocytes differ in the expression of surface immunoglobulin. Dev. Comp. Immunol. 6(3):473-479. (Dep. Microbiol. Univ. Mississippi Med. Cent. Jackson, Miss. 39216.).

Catfish peripheral blood and splenic lymphocytes were assayed for surface immunoglobulin using fifteen different mouse hybridoma antibodies to catfish immunoglobulin (Ig). These studies showed that this battery of monoclonal antibodies did not detect significant amounts of Ig on all lymphocytes. Unlike polyclonal antisera which demonstrated nearly 100% surface Ig^+ cells, the monoclonal antibodies detected ~40% surface Ig^+ cells. Furthermore, the percentage of Ig^+ cells reactive with two of these monoclonals, tentatively shown to react with two different types of catfish light chains, was found to be nearly additive when the two antibodies were mixed. Thus it seems that fish lymphocytes, like their mammalian counterparts, have two different populations of lymphocytes; one which contains abundant surface Ig and one which does not. Whether these two types of cells represent the fish equivalents of B and T cells remains to be determined. (Authors).

002204.

000055

Maas, M. G., Bootsma, R.

1982. Uptake of bacterial antigens in the spleen of carp (*Cyprinus carpio* L.). Dev. Comp. Immunol. Suppl. 2:47-52. (Dep. Pathol. Vet. Fac. Univ. Utrecht, The Netherlands.).

Carp (*Cyprinus carpio* L.) were injected with *Flexibacter columnaris* and *Aeromonas salmonicida* (carp erythrodermatitis agent) bacterins. In addition, carp were immersed in *F. columnaris* bacterins. Using the indirect fluorescent antibody technique, uptake and processing of bacterial antigens in carp spleen are described. After injection as well as after immersion, *F. columnaris* antigen was recovered in the ellipsoids of the spleen, apparently trapped by sheath cells. Processing of *A. salmonicida* antigen appeared to be less specific. The significance of these findings is discussed with regard to possible immunization of carp. (Authors).

002264.

000056

Margolis, L., Moravec, F.

1982. *Ramellogammarus vancouverensis* Bousfield (Amphipoda) as an intermediate host for salmonid parasites in British Columbia. Can. J. Zool. 60(5):1100-1104. (Dep. Fish. Oceans, Pacific Biol. Stn. Nanaimo, B. C. Canada V9R 5K6.).

Larvae of the nematode *Salvelinema walkeri* and metacercariae of the trematode *Crepidostomum metoecus* are recorded for the first time from the amphipod *Ramellogammarus vancouverensis* (Amphipoda: Gammaridae). Brief descriptions are given of both parasites, which as adults live in salmonid fishes. This report provides the first record of an intermediate host for *S. walkeri*, a swim-bladder parasite of salmonids of the Pacific region of North America, and of an intermediate host of a *Crepidostomum* species in the Pacific region of Canada. (Authors).

002257.

000057

Marks, J. E., Lewis, D. H.

1982. Exposure of largemouth bass to components of an osmotic infiltration technique: tolerance and efficacy. Prog. Fish-Cult. 44(3):155-157. (Dep. Vet. Microbiol. Parasitol. Texas A&M Univ. College Station, Tex. 77843.).

The authors determined the tolerance of fingerling, *Micropterus salmoides* to several hyperosmotic solutions and found that combinations of solutes were less toxic than single compounds. Relatively high osmotic pressures (1694 mOs) were tolerated for at least 3 min. Osmotic infiltration effectively introduced bovine serum albumin to where, by rocket immunoelectrophoresis, it was readily demonstrable in bass serum at levels as low as 0.00075 μg per 5-μL sample. (Ken Wolf).

002213.

000058

Maxwell, J. G. H.

1982. Infestation of the jack mackerel, *Trachurus declivis* (Jenyns), with the cymothoid isopod, *Ceratothoa imbricatus* (Fabricus), in south eastern Australian waters. J. Fish Biol. 20(3):341-349. (Div. Fish. Res. CSIRO Mar. Lab. P.O. Box 21, Cronulla, NSW 2230, Australia.).

The tongue biter, *Ceratothoa imbricatus*, a cymothoid isopod, commonly found on a number of Australian inshore temperate fish species, was recorded in the pelagic jack mackerel, *Trachurus declivis*, in 26 of 43 trawls. The infestation rate was low (1.76%) in the 26 trawls where the association was noted. It is suggested that infestation occurs at an early age and that subsequent growth by the isopod is mediated by the host. Estimates of the growth parameters indicate that the isopods are long lived, and can remain for at least 9 years on the host fish. Protandrous hermaphroditism, common in the Cymothoidae, is found in *C. imbricatus* with females attaining a large size in the bucco-pharyngeal cavity while the male, with suppressed growth, is restricted to the branchial arches. Although cymothoid isopods are commonly described as parasites, observable damage on the jack mackerel was restricted to the tissues at the points of attachment of the isopods. The effect of the isopod on the jack mackerel may not be as debilitating as might be expected and it is argued that the relationship may best be described as commensalism. (Author).

002232.

000059

McCarthy, D. H., Amend, D. F., Johnson, K. A., Bloom, J. V.

1983. *Aeromonas salmonicida*: determination of an antigen associated with protective immunity and evaluation of an experimental bacterin. J. Fish Dis. 6(2):155-174. (Tavolek Inc. Redmond, Wash. 98052.).

Protection against *Aeromonas salmonicida* was determined by passive immunization with rabbit antisera prepared with various antigens and by active immunization with related bacterins. Protective antigen was considered to be protein and most likely the external A layer of rough virulent strains. Some characteristics of the antigen, its production and response to physical and chemical treatments are given. Results of laboratory testing were favorable while field tests gave equivocal results. (Ken Wolf).

002200.

000060

McCauley, R. W., Binkowski, R. P.

1982. Thermal tolerance of the alewife. Trans. Am. Fish. Soc. 111(3):389-391. (Biol. Dep. Wilfrid Laurier Univ. Waterloo, Ontario N2L 3C5, Canada.).

The alewife *Alosa pseudoharengus* often dies in large numbers in the Great Lakes during the spring. The reasons for this mass mortality are still unclear although one of the causes is believed to be thermal death when alewives encounter warm inshore temperatures. Published reports on upper lethal temperature indicate that the ultimate upper lethal temperature of adult alewives is near 25°C. In contrast, young of the year appear to have an ultimate upper incipient lethal temperature slightly above 30°C. Published values of thermal tolerance of the adults may be low because of the difficulty of obtaining healthy specimens for experimentation. We found that when adult alewives were well adapted to laboratory conditions they could survive temperatures several degrees higher than predicted. The ultimate upper lethal temperature was estimated to be in the range 31-34°C. (Authors).

002245.

000061

McCormick, J. H., Stokes, G. N.

1982. Intraovarian invasion of smallmouth bass oocytes by *Proteocephalus ambloplitis* (Cestoda). J. Parasitol. 68(5):973-975. (U. S. Environ. Prot. Agency, Environ. Res. Lab. Duluth, 6201 Congdon Blvd. Duluth, Minn. 55804.).

Histological preparations showed that anterior ends of pleurocercoids enter advanced vitellogenic oocytes, and thus the study provided the first evidence of direct destruction of oocytes in infected fish. Yolk nutrients are made available to the parasite. (Ken Wolf).

002169.

000062

Mergo, J. C. Jr., White, A. M.

1982. Two new species of dactylogyridae (Monogenea) from the silver redhorse, *Moxostoma anisurum*. J. Parasitol. 68:(5):946-948. (Dep. Biol. John Carroll Univ. Cleveland, Ohio 44118.).

Pseudomurraytrema milleri sp. n. and *Pellucidhaptor moxostomi* sp. n. are described from the gills of the silver redhorse, *Moxostoma anisurum* (Rafinesque). (Authors).

002171.

000063

Miller, N. W., Tripp, M. R.

1982. An immunoinhibitory substance in the serum of laboratory held killifish, *Fundulus heteroclitus* L. J. Fish Biol. 20(3):309-316. (Sch. Life Health Sci. Univ. Delaware, Newark, Del. 19711.).

Serum of the killifish, *Fundulus heteroclitus*, maintained under laboratory conditions for more than 4 weeks, contained a factor that depressed the immunocytoadherence response to SRBC. When serum was injected into immunocompetent fish 48 h prior to antigen stimulation it was effective; when injected simultaneously with the antigen there was no effect. Fractionation of the serum by ultracentrifugation suggests that the inhibitor is either low or very low density lipoprotein. Hpophysectomy decreased immune inhibition suggesting that the production of the inhibitor may be under the control of the pituitary. (Authors).

002238.

000064

Mitchell, L. G., Ginal, J., Bailey, W. C.

1983. Melanotic visceral fibrosis associated with larval infections of *Posthodiplostomum minimum* and *Proteocephalus* sp. in bluegill, *Lepomis macrochirus* Rafinesque, in central Iowa, U.S.A. J. Fish Dis. 6(2):135-144. (Dep. Zool. Iowa State Univ. Ames, Iowa 50011.).

Severe melanotic liver and visceral fibroses in bluegill associated with infections of plerocercoids of *Proteocephalus* sp. and metacercariae of the digenean *Posthodiplostomum minimum*, were studied by light and transmission electron microscopy. Results of examinations are described and illustrated. (Authors).

002189.

000065

Miyazaki, T.

1982. Pathological study on streptococcicoses histopathology of infected fishes. Fish Pathol. 17(1):39-47. (Dep. Fish. Mie Univ. Edobashi, Tsu, Mie, Japan.).

The author studies histopathologically various Streptococcicoses: 1) infections with α-hemolytic bacteria in sea-cultured yellowtail (*Seriola quinqueradiata*), striped beakperch (*Oplegnathus fasciatus*), Japanese horse mackerel (*Trachurus japonica*) and striped jack (*Caranx delicatissimus*), 2) infections with β-hemolytic bacteria in sea-cultured Japanese flounder (*Paralichthys olivaceus*), ayu (*Plecoglossus altivelis*) and rainbow trout (*Salmo gairdneri*) which were reared in freshwater ponds. The bacteria frequently infected eyes of fishes. Histopathologically α-hemolytic bacteria usually caused granulomatous inflammation at infected lesions of yellowtail, striped beakperch, Japanese horse mackerel and striped jack. β-hemolytic bacteria caused systemic infection with septicemia in ayu and rainbow trout, and extensive suppurative inflammation in eyes of Japanese flounder. (Authors). (Paper in Japanese).

002253.

000066

Moser, M., Haldorson, L.

1982. Parasites of two species of surfperch (Embiotocidae) from seven Pacific Coast locales. J. Parasitol. 68(4):733-735. (Cent. Coastal Mar. Stud. Univ. California, Santa Cruz, Santa Cruz, Calif. 95064.).

The parasites in two species of embiotocid perches, *Embiotaoca lateralis* and *Damalichthys (Rhacochilus) vacca*, were surveyed at seven locales from Puget Sound, Washington, to Santo Tomas, Mexico, during the years 1974 to 1976. (Authors).

002212.

000067

Mulcahy, D., Bauersfeld, K.

1983. Effect of loading density of sockeye salmon, *Oncorhynchus nerka* (Walbaum), eggs in incubation boxes on mortality caused by infectious haematopoietic necrosis. J. Fish Dis. 6(2):189-193. (U.S. Fish Wildl. Serv. Natl. Fish. Res. Cent. Bldg. 204, Naval Support Activity, Seattle, Wash. 98115.).

Replicates boxes of about 4 m^3 volume were stocked with 900,000, 650,000, or 350,000 eggs and supplied with 190 L/min water at 7-8°C. Survival from egg to fry did not differ significantly between stocking densities. Infectious hematopoietic necrosis occurred in at least one box of each density, but it was least (~ 40%) at low density and highest (90-100%) at intermediate and high density. (Ken Wolf).

002201.

000068

Mulcahy, D., Pascho, R. J., Jenes, C. K.

1983. Titer distribution patterns of infectious hematopoietic necrosis virus in ovarian fluids of hatchery and feral salmon populations. J. Fish Dis. 6(2):183-188. (U.S. Fish Wildl. Serv. Natl. Fish. Res. Cent. Bldg. 204, Naval Support Activity, Seattle, Wash. 98115.).

The presence of infectious hematopoietic necrosis virus and its titer was determined for ovarian fluids from three populations of sockeye and four of chinook salmon. The virus was detected in all seven populations, and its prevalence ranged from 39 to 100% (av 85%). Mean viral titers varied from year-to-year, but epizootics could not be related to the rate of infection or to virus titer. Tabular and graphic data are given. (Ken Wolf).

002202.

000069

Murchaleno, R. A.

1982. Some pollution-associated diseases and abnormalities of marine fishes and shellfishes: a perspective for the New York Bight. Pages 327-346 *in* G. F. Mayer, ed. Ecological stress and the New York Bight: science and management. Estuarine Res. Fed. Columbia, S. C. 29201. (Natl. Mar. Fish. Serv. Northeast Fish. Cent. Oxford Lab. Oxford, Md. 21654.).

In recent years, there has been a tendency to associate environmental degradation with diseases of marine fishes and shellfishes. A brief review is provided of pollution-associated diseases caused by viruses and bacteria and a number of pollution-associated diseases whose etiology is uncertain. Microbial diseases discussed include lymphocystis, herpeslike virus, *Baculovirus*, vibriosis, and shell disease; diseases of uncertain etiology include fin rot, skeletal anomalies, and black gill; neoplastic diseases include epidermal papilloma, stomatopapilloma, hepatoma, and several neoplastic diseases of shellfishes. The prevelance of these diseases varies geographically, and in any one area usually has not been statistically compared to an acceptable reference area. The prognosis for the animal also varies; some diseases are fatal and others have little effect on their hosts. The only pollution-associated diseases that are numerically prevalent in the New York Bight are shell disease, fin rot, and black gill disease. (Author).

002261.

000070

Murchelano, R. A., Ziskowski, J.

1982. Fin rot disease in the New York Bight (1973-1977). Pages 347-358 *in* G. F. Mayer, ed. Ecological stress and the New York Bight: science and management. Estuarine Res. Fed. Columbia, S. C. 29201. (Natl. Mar. Fish. Serv. Northeast Fish. Cent. Oxford Lab. Oxford, Md. 21654.).

The results of research on the prevalence and etiology of fin rot disease of New York Bight winter flounder, *Pseudopleuronectes americanus*, are presented. Except for 1975 and 1976, significant differences ($P < 0.05$) in disease prevalence were found between the apex and Sandy Hook/Raritan Bays, the apex and control area, and Sandy Hook/Raritan Bays and control area. The apex had the highest prevalence of the disease (7.4%) for the 5-year period from 1973 to 1977. It was not possible to determine whether the etiology of the fin rot is infectious or noninfectious. Concentrations of trace metals and polychlorinated biphenyls in tissues were not elevated consistently. Based on bacteriologic, histopathologic, and immunologic studies, the disease probably is not fatal. Negligible mortality and the absence of an extensive winter flounder fishery in the New York Bight both make it unlikely that there is a major effect on the population dynamics of the species. The most important aspect of the presence of fin rot disease in Bight winter flounder rests in its

value as an indicator of environmental stress. (Authors).

002263.

000071

Muroga, K., Kawatow, K., Ichizono, H.

1981. Infestation by *Allela macrotrachelus* (Copepoda) of cultured black sea-bream. Fish Pathol. 16(3):139-144. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama 720, Japan.).

From August 1978 to August 1980, a continuous field investigation was made on *Alella macrotrachelus* in black sea-bream (*Acanthopagrus schlegeli*) cultured in a private farm in the Inland Sea of Japan. *Allella macrotrachelus* was observed on gills of the fish throughout the year. The parasite was also common in some farms, but in few that were situated near the mouth of rivers. The average number of female parasites on a fish began to increase immediately after the start of rearing (August), and reached the first peak in winter. It attained the second peak in the next spring, then decreased considerably in late summer. The most dangerous stage of this parasitic disease seemed to be in the first winter. From histopathological observations, it was found that the female parasite took the epithelial cells of gill lamellae and erythrocytes. The hyperplasia of the epithelial cell layer, edema and hemorrhage in the gill lamellae were also caused by the parasite. (Authors). (Paper in Japanese).

002223.

000072

Nakamura, Y.

1982. Doxycycline. Fish Pathol. 17(1):67-76. (Agric. Res. Dev. Pfizer Taito Co. Ltd. Tokyo, Japan.).

The results of basic and applied studies with doxycycline are summarized as follows. Doxycycline was stable in substance and preparation. It also keeps its stability in feed for yellowtail. The half life of doxycycline was 7 days in seawater or in seawater and active sludge. Doxycycline had very low toxicity for the yellowtail: its safety was high. It was quickly absorbed in body of experimental animals and was distributed systemically. Doxycycline was efficacious against streptococcosis in yellowtail at the administration of 20-50 mg/kg of body weight. Its withdrawal period was 20 days. (Author). (Paper in Japanese).

002225.

000073

Newsome, C. S., Piron, R. D.

1982. Aetiology of skeletal deformities in the zebra danio fish (*Brachydanio rerio*, Hamilton-Buchanan). J. Fish. Biol. 21(2):231-237. (Fish Unit, Environ. Safety Lab. Unilever Res. Colworth House, Sharnbrook, Bedfordshire, England.).

Laboratory bred fish are prone to skeletal deformities. This condition appears related to diet and has been studied by breeding from different broods of fish for three generations. Two broods bred using two commercially available tropical flaked foods developed severe spinal curvature 3 to 6 weeks post-hatching. A third brood of fish fed exclusively on live food did not develop any deformity. The results demonstrate that a dietary factor is responsible for the deformities and that the zebra danio is especially susceptible to this factor as other species breed normally when fed the same commercial diet. Analysis of the diets showed no deficiency in either ascorbic acid (Vitamin C) or tryptophan, deficiency of either being associated with scoliosis and lordosis in fish. The analysis did show, however, a relationship between the lead content of the diet and the incidence of deformities. Lead has previously been implicated in skeletal deformities in second and third generation brook trout, *Salvelinus fontinalis*. (Authors).

002174.

000074

Nicholson, B. L., Caswell, P.

1982. Enzyme-linked immunosorbent assay for identification of infectious pancreatic necrosis virus. J. Clin. Microbiol. 16(3):469-472. (Dep. Microbiol. Univ. Maine, Orono, Maine 04469.).

The sensitivity, reproducibility, and specificity of an enzyme-linked immunosorbent assay for the identification of infectious pancreatic necrosis virus was determined. It was shown that $10^{2.5}$ tissue culture infectious doses could be assayed by this method. The assay provided significant advantages in terms of time and ease of performance over the routinely employed serological tests. When an antiserum against a single isolate was

used, it was possible to identify nine of ten North American isolates, four of six European isolates, and one isolate from Taiwan. (Authors).

002203.

000075

Nomura, T., Tomioka, K., Shimizu, I.

1982. Vibriosis in chum salmon fry – I. The occurrence and symptoms. Sci. Rep. Hokkaido Salmon Hatchery 36:63-69. (Hokkaido Salmon Hatchery, 2-2 Nakanoshima, Toyohiraku, Sapporo, Hokkaido, Japan.).

This communication describes an outbreak of vibriosis among chum salmon fry during experimental breeding in shore pond. The epizootic occurred among a group of 50,000 chum salmon fry, mean weight 1.47 g. Highest mortality was recorded as 2.1% per day. Water temperature varied during the period of breeding within the range of 14-14.5°C. Internally numerous petechial hemorrhages were present on the liver. All culture plates inoculated with material of kidney and liver from diseased fish, showed pure or predominant growth of gram-negative curved rod. The bacterium thought to be the causative organisms of the present outbreak was identified as *Vibrio* sp. Histopathology of liver tissue revealed marked hemorrhages and presented a large numer of distinctly curved bacilli in all diseased fish. This is the first record of vibriosis of chum salmon fry in Hokkaido. (Authors). (Paper in Japanese).

002220.

000076

Ohnishi, K., Watanabe, K., Jo, Y.

1982. *Pastuerella* infection in young black seabream. Fish Pathol. 16(4):207-210. (Tokushima Pref. Fish. Exp. Stn. Hiwasa, Tokushima, 779-23, Japan.).

At the middle of July 1979, a bacterial infection occurred in a young population of black seabream (*Acanthopagrus schlegeli*) cultured in three tanks. These fish had been reared in sea water tanks since they hatched out at the end of May. The epizootic broke out in all tanks, lasted about 1 month, and killed 3300 fish out of 8000 (41% mortality). The causative agent isolated from liver or kidney materials of all the fish examined was identified as *Pasteurella piscicida* by comparing the characteristics of the present isolates with that of the isolates from black seabream by Muroga et al. (1977). The source of the infection was thought to be the sea water supplied to the tanks because of the frequent occurrence of Pseudotuberculosis (*P. piscicida* infection) in yellowtail (*Seriola quinqueradiata*) in adjacent area. (Authors). (Paper in Japanese).

002229.

000077

Paterson, W. B., Desser, S. S.

1982. The biology of two *Eimeria* species (Protista: Apicomplexa) in their mutual fish hosts in Ontario. Can. J. Zool. 60(5):764-775. (Dep. Zool. Univ. Toronto, Toronto, Ont. Canada M5S IAI.).

Eimeria degiustii and *E. iroquoina* were studied in natural infections of the mutual cyprinid hosts the common shiner, *Notropis cornutus*, and the fathead minnow, *Pimephales promelas*. Experimental infections involved lab-reared fathead minnows. Oocysts were acclimated to different temperatures to investigate the effects upon the parasite's development and infectivity. Field and laboratory results are given. (Authors).

002236.

000078

Peterson, J. E.

1982. Analysis of bacterial kidney disease (BKD) and BKD control measures with erythromycin phosphate among cutthroat trout (*clarki bouvieri*). Salmonid 5(6):12-15. (Montana Dep. Fish, Wildl. Parks, Bluewater Springs Trout Hatchery, Bridger, Montana 59014.).

Bacterial kidney disease (BKD) has been isolated from cutthroat trout (*Salmo clarki bouvieri*) mortalities at the Yellowstone River Trout Hatchery since 1976. Daily mortalities were monitored for presence and extent of BKD. The testes of maturing males was often the best place to isolate the BKD organism. Erythromycin injections worked well to control the BKD pathogen in adult brood fish. Injections were required at 30-35 day intervals. Erythromycin was administered on a practical rather than experimental basis; uninjected controls were not maintained because of limited facilities and chance of reinfection. All eggs collected during spawning were water hardened in erythromycin. Fish from eggs water hardened in erythromycin in 1978 have developed for over three years without showing any sign of BKD, and not one

BKD organism was found in any fish examined from this lot. (Authors).

002251.

000079

Plumb, J. A., Schwedler, T. E., Limsuwan, C.

1983. Experimental anesthesia of three species of freshwater fish with etomidate. Prog. Fish-Cult. 45(1):30-33. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36849.).

Etomidate (ethyl-1-methylbenzyl-imidazole-5-carboxylate) is an experimental nonbarbiturate hypnotic agent used intravenously for anesthetic induction in humans and domestic or laboratory mammals. Three species of fish (golden shiners, *Notemigonus crysoleucas*; striped bass, *Morone saxatilis*; and channel catfish, *Ictalurus punctatus*) were anesthetized for up to 96 h with various concentrations of etomidate. Mortality during the 48-h recovery period after anesthesia was low in all species of the fish. Two-year-old channel catfish withstood from 0.4 to 3.6 mg/L for 80 min with low mortality at the higher concentrations, but anesthesia was induced at 0.8 to 1.2 mg/L. Etomidate compared favorably to quinaldine and tricaine methanesulfonate under the conditions tested. (Authors).

002241.

000080

Reimchen, T. E.

1982. Incidence and intensity of *Cyathocephalus truncatus* and *Schistocephalus solidus* infection in *Gasterosteus aculeatus*. Can. J. Zool. 60(5):1091-1095. (Dep. Zool, Univ. Alberta, Edmonton, Ala. Canada T6G 2E9.).

Cyathocephalus truncatus, a cestode usually found in salmonids, and plerocercoids of *Schistocephalus solidus* are reported from a population of *Gasterosteus aculeatus* on the Queen Charlotte Islands, British Columbia. (Author).

002237.

000081

Rohovec, J. S., Amandi, A.

1981. Incidence of viral erythrocytic necrosis among hatchery reared salmonids of Oregon. Fish. Pathol. 15(3,4):135-141. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331.).

A survey was undertaken to determine the incidence of viral erythrocytic necrosis (VEN) among hatchery reared salmonids in the state of Oregon. Thirty-five different stocks of fish were examined. Included were steelhead trout (*Salmo gairdneri*), coho (*Oncorhynchus kisutch*), chum (*O. keta*), chinook (*O. tshawytscha*), and kokanee (*O. nerka*) salmon. Inclusion bodies typical of VEN were found in the red blood cells of fish from 9 of the 35 stocks examined. Chum salmon were most heavily infected, but inclusion bodies were also detected in blood from coho and chinook salmon and steelhead trout. Progeny of selected populations of VEN infected adults were examined and cytoplasmic inclusions were found in erythrocytes of chum and coho juveniles. (Authors).

002249.

000082

Sakai, D. K.

1982. Transferability of an ability to synthesize hemolytic antibody in the allogenic lymphocyte transfer of rainbow trout. Bull. Jpn. Soc. Sci. Fish. 48(7):911-916. (Hokkaido Fish Hatchery, Nakanoshima 2-2, Toyohira, Sapporo 062, Japan.).

A lymphhocyte transfer reaction, which is one of the most valuable and direct means to know the immunological functions of lymphocytes in vivo, was performed using juvenile rainbow trout *Salmo gairdneri*, steelhead trout *S. gairdneri*, kokanee (sockeye) salmon *Oncorhynchus nerka* and masu salmon *O. masou*. The trout and salmon were immunized by the intraperitoneal injection of washed goldfish red blood cells (GFRBC), and after 5 days or 1 week, lymphocytes were isolated from the blood and spleen of GFRBC-primed donors. The lymphocytes were transferred to unprimed recipients by an intravascular injection and the recipients were kept at 10°C for 5 days or 1 week. When lymphocytes from donors were transferred to recipients in the relations of rainbow trout-to-rainbow trout and steelhead trout-to-rainbow trout, the antibody of the recipients was assayed at high leveled titers similar to the normal antibody response. However, transferability of an ability to synthesize antibody could not be traced throughout transferred lymphocytes in the relations of kokanee salmon-to-rainbow trout and masu salmon-to-rainbow trout. Thus, lymphocytes in trout belonging to *S. gairdneri* can successfully be transplanted without encountering rejection in recipients, even though trout used as donors and recipi-

ents are regarded as an outbred line in immunogenetics. (Author).

002167.

000083

Sakai, D. K.

1981. Cooperative opsonic functions of antibody and serum complement in the phagocytosis of peritoneal exudate cells derived from rainbow trout. Sci. Rep. Hokkaido Fish Hatchery 36:51-56. (Hakkaido Fish Hatchery 2, Nakanoshima-2, Toyohira-ku, Sapporo 062, Japan.).

Peritoneal exudate cells (PEC) were obtained from juvenile rainbow trout stimulated by injection of sterilized liquid paraffin. Peritoneal exudate cells contained three kinds of white blood cells, small lymphocytes 44-50%, and neutrophile-like and macrophage-like cells of 42-50%. The rates of neutrophile-like cells-to-macrophage-like cells were approximately 1:1. When PEC were incubated at 20°C for 2 h with viable *Aeromonas salmonicida* PEC containing the bacteria could be scarcely discovered in unimmunized rainbow trout and those immunized with formalin-killed *A. salmonida*. The addition of the heat-inactivated antiserum slightly improved the phagocytic functions of PEC. The supplement of rainbow trout complement as fresh normal serum, however, indicated an incapacity of improving the efficiency of the phagocytosis. The coexistence of antibody and complement markedly enhanced phagocytic activity of PEC. Almost all the PEC belonging to neutrophile-like and macrophage-like cells included the considerable numbers of bacterial cells in the presence of the antibody and complement. The presence of Fc and C3b receptors in the phagocytic PEC of rainbow trout were suggested by the cooperative opsonic functions of the antibody and complement as well as in neutrophiles and macrophages of murines and humans. (Authors). (Paper in Japanese).

002186.

000084

Sakai, D. K.

1982. Titration of hemolysin and analysis of primary antibody response in rainbow trout. Bull. Jpn. Soc. Sci. Fish. 48(3):345-349. (Hokkaido Fish Hatchery, 2, Nakanoshima-2, Toyohira, Sapporo 062, Japan.).

Hemolytic complement activity (CH_{50} unit) of pooled normal serum was determined as 32.5 CH_{50} units mL by reacting goldfish red blood cell (GFRBC) sensitized with anti-GFRBC hemolysin (inactivated by heating at 44°C for 20 min) and definitely dilluted complement at 30°C for 60 min. From the decided CH_{50} unit value, the dilution of the complement for the preparation of complement bearing 2 CH°sub5°sub0° units was calculated at 1:44, and this diluted complement possessed an ability to hemolyze 100% of 1×10^7 sensitized GFRBC when this complement of 0.5 mL was added to the total reaction volume of 1.5 mL. In addition, this complement revealed hardly any spontaneous or non-specific hemolysis activity against usensitized GFRBC under same conditions. Hemolysin titration could be accomplished without trouble in rainbow trout immunized with intramuscular (i. m.) and intraperitoneal (i. p.) injections of 10^8 GFRBC per a juvenile. Hemolysin samples, which were taken out from primed (i. p.) fish group held at a water temperature of 10°C, drastically enhanced the values to a high of 641± 251 after 5 days. In succession, hemolysin titers rapidly descended to 485± 213 after 7 days through 55± 21 after 15 days hemolytic activity became undetectable after 20 days. From the results of hemolysin titration, it was concluded that the primary antibody response of primed rainbow trout is markedly transitory. (Author).

002246.

000085

Sako, H., Hara, T.

1981. Effect of water temperature on the growth of *Aeromonas salmonicida* inoculated into yamame, *Oncorhynchus masou*. Bull. Natl. Res. Inst. Aquacult. 2:73-81. (Natl. Res. Inst. Aquacult. 224-1, Hiruta, Tamaki-cho, Watarai-gun, Mie-ken, 519-04, Japan.).

In vitro and in vivo experiments were carried out to know the effect of temperature on the growth of *A. salmonicida* in yamame (*Oncorhynchus masou*). *Aeromonas salmonicida* was inoculated in nutrient broth at 5, 10, 15, and 20°C and growth rates were studied. The bacteria were also inoculated both intraperitoneally and intramuscularly into yamame at a dose of 10^{-4} mg wet weight per 100 g body weight. Inoculated fish were kept at water temperatures of 10, 15, and 20°C and viable counts of *A. salmonicida* in the blood, spleen, liver, kidney, and heart were examined. *Aeromonas salmonicida* cultured in nutrient broth showed faster growth as the incubation temperature increased. Viable counts of *A. salmonicida* in all organs examined increased faster and period required for death became shorter as the temperature increased. Numbers of viable bacteria in the

spleen and kidney were larger than that in the blood at all temperatures irrespective of the route of administration of bacteria. These results indicate that temperature strongly affects the growth rate of *A. salmonicida* in vivo as well as in vitro. (Authors). (Paper in Japanese).

002243.

000086

Sanborn, M. R., Wan, S. K., Bulard, R.

1982. Microwave sterilization of plastic tissue culture vessels for reuse. Appl. Environ. Microbiol. 44(4):960-964. (Dep. Microbiol. Oklahoma State Univ. Stillwater, Okla. 74078.).

A simple protocol has been developed for recycling plastic tissue culture vessels. The killing properties of microwaves were used to decontaminate plastic tissue culture vessels for reuse. Nine bacterial cultures, four gram-negative and five gram-positive genera, including two *Bacillus* species, were used to artificially contaminate tissue culture vessels. The microwaves produced by a home-type microwave oven (2.45 gHz) were able to decontaminate the vessels with a 3-min exposure. The same exposure time was also used to completely inactivate the following three test viruses: polio type 1, parainfluenza type 1 (Sendai), and bacteriophage T4. The recycling procedure did not reduce the attachment and proliferation of the following cell types: primary chicken and turkey embryo, HEp-2, Vero, BGMK, and MK-2. (Authors).

002218.

000087

Sato, M., Yoshinaka, R., Kondo, T., Ikeda, S.

1982. Accumulation of underhydroxylated collagen in ascorbic acid-deficient rainbow trout. Bull. Jpn. Soc. Sci. Fish. 48(7):953-957. (Dep. Fish. Fac. Agric. Kyoto Univ. Kyoto 606, Japan.).

Amino acid compositions of collagens from the skin and vertebrae were determined in rainbow trout which had been fed with purified diets containing different amounts of L-ascorbic acid (AsA) for 11 weeks. Hydroxyproline contents of collagens from the skin and vertebrae were comparatively low in the groups receiving 0 or 2 mg of AsA per 100 g of diet, when compared with the control fish receiving 200 mg of AsA per 100 g of diet. The dietary AsA levels had little effect on the hydroxylysine content of collagen. The thermal stability of the skin collagen was investigated using changes in viscosity. The viscosity of collagen solution was measured after keeping the sample for 30 min at some fixed temperature between 5 and 25°C. The denaturation temperatures of collagens from the groups receiving 5 to 200 mg of AsA per 100 g of diet were 18.1 to 18.3°C, whereas those of collagens from the groups receiving 0 and 2 mg of AsA per 100 g of diet were 16.6 and 17.1°C, respectively. The viscosities of collagens from the groups receiving 5 to 200 mg of AsA per 100 g of diet were not decreased markedly up to 15°C, whereas those of collagens from the groups receiving 0 and 2 mg of AsA per 100 g of diet were low around 10°C. These results indicate that an underhydroxylated thermally labile collagen is formed and accumulates in the tissues of the fish which are fed with an AsA-deficient diet. (Authors).

002175.

000088

Shibahara, T.

1982. Damages in cultured marine-fishes caused by streptococcicosis in Mie Prefecture. Fish Pathol. 17(1):49-53. (Mie Prefect. Owase Fish. Exp. Stn. Hayashi, Owase, Mie, Japan.).

We have been investigating races of sea-cultured fishes, production, number of fish-culturists, occurrence of diseases, and losses due to diseases in Mie Prefecture since 1960. The author has concentrated on investigation of streptococcicosis of yellowtail *Seriola quinqueradiata* and other sea-cultured fishes because of great losses since 1975. This paper describes the results of investigations for 1960 through 1981 and author's opinion on prophylaxis and treatment of streptococcicosis in yellowtail. (Author). (Paper in Japanese).

002256.

000089

Shiomitsu, K.

1982. Isolation of *Streptococcus* sp. from the brain of cultured yellowtail. Fish Pathol. 17(1):27-31. (Kagoshima Prefect. Fish. Exp. Stn. Kinko-cho, Kagoshima-shi, Kagoshima, Japan.).

The author has been performing isolation of *Streptococcus* sp. from the brain of diseased yellowtail (*Seriola quinqueradiata*) since January 1979. This method has been useful to readily diagnose Streptococcal infection of fish with pathological

symptoms such as exophthalmos, protrusive lesions on the inside of the opercle and the caudal peduncle, and epicarditis. Moreover, this method was applicable to infected fish which did not yet exhibit pathoglogical symptoms. This paper describes the results of the study on bacterial isolation with the above mentioned method in 1979 and 1980. (Authors). (Paper in Japanese).

002255.

000090

Sin, A. W., Chiu, M. T. L.

1982. Summer and winter kills in fish ponds of Hong Kong and their possible prediction. Aquaculture 29(1,2):125-135. (Fish. Res. Div. Agric. Fish. Dep. Canton Road Gov. Off. 12-14th floor, 393, Canton Road, Kowloon, Hong Kong.).

Summer and winter fish kills in earthen ponds in Hong Kong were found to be caused by excessive manuring and the collapse of the algal populations, resulting in oxygen depletion and increases in ammonia concentration. According to the change in patterns of water quality which were basically similar for both trials, the observation period could be divided into the pre-bloom, bloom, kill, and recovery stages. Kills occurred in ponds when the dissolved oxygen declined below 10% saturation at 20-30°C. This was usually accompanied by increases in concentrations of chlorophyll *a* above 0.25 mg/L and of ammonia over 0.35 mg/L. Fish kills could thus be predicted if the water quality was closely monitored. (Authors).

002206.

000091

Stevenson, R. M. W., Daly, J. G.

1982. Biochemical and serological characteristics of Ontario isolates of *Yersinia ruckeri*. Can. J. Fish. Aquat. Sci. 39(6):870-876. (Dep. Microbiol. Univ Guelph, Guelph, Ont. NIG 2WI, Canada.).

During testing hatchery and wild fish from Ontario sources, we isolated bacteria that had sufficient characteristics in common with *Yersinia ruckeri* to suggest they were strains of this organism. Three isolates from brook trout (*Salvelinus fontinalis*), rainbow trout (*Salmo gairdneri*), and cisco (*Coregonus artedii*) biochemically resembled the sorbitol-fermenting Serovar II strain of *Y. ruckeri*, but gave cross reactions with antiserum to the Hagerman strain, Serovar I. A fourth isolate from brown trout (*Salmo trutta*) appeared to be different from the three previously described serovars. A fifth isolate previously obtained from muskrat (*Ondatra zibethica*) intestine biochemically and serologically corresponded to the Hagerman serovar. We suggest that the geographic range of *Y. ruckeri* and variations in its biochemical and serological properties are greater than previously believed. These findings are of significance in diagnosis and regulation of enteric redmouth disease of salmonids. (Authors).

002235.

000092

Suga, Y.

1982. Spiramycin. Fish Pathol. 17(1):87-99. (Kyowa Hakko Kogyo Co. Ltd. Ohtemachi 1-6-1, Chiyoda-ku, Tokyo, 100 Japan.).

Spiramycin for fishery drugs had the governmental approval for production and was introduced to the market in 1981. This paper deals with general properties and various experimental data of spiramycin embonate concerning physicochemistry, stability, anti-bacterial activities, general pharmacology, absorption, excretion, toxicity, safety, residue and clinical studies. (Author). (Paper in Japanese).

002183.

000093

Thune, R. L., Graham, T. E., Riddle, L. M., Amborski, R. L.

1982. Extracellular products and endotoxin from *Aeromonas hydrophila*: effects on age-0 channel catfish. Trans. Am. Fish. Soc. 111(3):404-408. (Dep. Vet. Sci. Louisiana State Univ. Baton Rouge, La. 70803.).

The effects of the extracellular products (ECP) and endotoxin from *Aeromonas hydrophila* grown in a defined medium were determined following intraperitoneal injection of young-of-the-year channel catfish *Ictalurus punctatus*. Endotoxin had no lethal effects in doses as high as 400 μg per 7.2 g fish, whereas ECP had a 48-h median lethal concentration (LD_{50}) of 15.7 μg per 7.2 g fish. Sublethal doses of ECP often produced many of the gross pathologies associated with *A. hydrophila* infections. The primary lethal factor was heat-labile

at 56°C for 10 min, but a heat-stable component was also implicated. (Authors).

002228.

000094

Tisa, M. S., Strange, R. J., Peterson, D. C.

1983. Hematology of striped bass in fresh water. Prog. Fish-Cult. 45(1):41-44. (Dep. For. Wildl. Fish. Univ. Tenn. P. O. Box 1071, Knoxville, Tenn. 37901.).

Eight hematological characteristics were measured on a total of 40 adult striped bass (*Morone saxatilis*) taken during four collections from three freshwater reservoirs. The range of mean hematological values from the four samples was as follows: hematocrit 31-38%, hemoglobin 7-11 g/100 mL, plasma osmolality 321-381 mOs, plasma chloride 129-156 meq/L, plasma glucose 77-118 mg/100 mL, plasma cortisol 0.77-6.33 μg/100 mL, total plasma protein 4.3-4.9 g/100 mL, and total plasma cholesterol 322-499 mg/100 mL. These means generally fell within the range of means reported for apparently healthy striped bass from salt water. The variability within our samples was comparable to the variability associated with same measurements or fish held under controlled laboratory conditions. We attribute this to the rapid collection and preparation technique we employed in the field. No consistent pattern in the differences between collections was discerned and they may be attributed to normal variations due to season, habitat, diurnal rhythms, sex, or diet. Because of this we pooled the individual values and calculated normal ranges for each of the hematological characteristics. (Authors).

002248.

000095

Upton, S. J., Duszynski, D. W.

1982. Development of *Eimeria funduli* in *Fundulus heteroclitus*. J. Protozool. 29(1):66-71. (Dep. Biol. Univ. New Mexico, Albuquerque, N. M. 87131.).

Histological sections were made of heart, liver, hepatopancreas, spleen, gall bladder, kidney, intestine, peri-intestinal fat, reproductive organs, and brain from *F. grandis* sacrificed at 1, 2, ●i6, 12, 18, and 24 h and from *F. heteroclitus* at 5, 6, 9, 14, 19, 24, 29, 34, 39, and 44 days after consuming naturally infected shrimp. We first found merogonous stages at day 9 postinfection (p. i.). Mature meronts were found 14 days p.i. The majority contained 8-16 (mean, 13) merozoites, but a few meronts had 18-26 (22) merozoites. Gamonts first appeared on day 14, were mature by day 19, and fertilization was completed by day 24 p.i. After sporoblast formation, sporopodia appeared during sporocyst wall formation, between days 24 and 29 p.i. Sporozoite formation was completed by day 44 p.i. in most sporocysts. (Authors). END.

002239.

000096

Vinjoy, M., Prieto, A.

1979. Parasitofauna of the largemouth bass (*Micropterus salmoides*) in the Tesoro lagoon. (Parasitofaune de la Trucha (*Micropterus salmoides*) En La Laguna Del Tesoro.) Rev. Cubana Invest. Pesqueras 4(3):54-67. (Cent. Invest. Pesqueras, La Habana, Cuba.).

During 1978, a detailed study dealing with parasitic fauna found within the internal organs and fins of trout (sic) species was carried out, finding two metacercariae pertaining to the Superfamily *Strigeoidea trematodes*, *Posthodiplastomum minimum* and *Neascus* sp. respectively. There is another metacercaria encysted in muscles and fins and a nematode larva within the perivisceral mass, the first one from the Superfamily Clinostomatoidea (*Clinostomum marginatum*) and the other one pertaining to *Contracaecum genus*, respectively. It has also been observed a monogeneous trematode of the family Dactilogyridae in the gill filaments. Statistical analyses showed that health is not affected by the different infestation intensities of *Posthodiplastomum minimum* since there is a correlationship between this parasite and the fish total length which behaves as a quadratic. Attention must be given to the likely harmful results which the introduction of Dorosoma in this lagoon may yield as trout (sic) feeding. (Authors). (Paper in Spanish).

002208.

000097

Waltman, W. D. II,, Shotts, E. B., Hsu, T. C.

1982. Enzymatic characterization of *Aermonas hydrophila* complex by the API ZYM system. J. Clin. Microbiol. 16(4):692-696. (Dep. Med. Microbiol. Coll. Vet. Med. Univ. Georgia, Athens, Ga. 30605 .).

Enzymatic characterization of 48 *Aeromonas hydrophila* complex isolates from various sources

was determined with the API ZYM system (Analytab Products, Plainview, N.Y.). All isolates lacked valine and cystine aminopeptidases, chymotrypsin, α-mannosidase, α-fucosidase, α-galactosidase, and β-glucuronidase but possessed caprylate esterase-lipase, leucine aminopeptidase, acid phosphatase, phosphoamidase, and N-acetyl-β-glucosaminidase. Variability was found in the presence of alkaline phosphatase, butyrate esterase, myristate lipase, trypsin, β-galactosidase, α-glucosidase, and β-glucosidase. No significant differences were evident among the enzymatic profiles of isolates from various sources. (Authors).

002182.

000098

Winkelhake, J. L, Chang, R. J.

1982. Acute phase (C-reactive) protein-like macromolecules from rainbow trout (*Salmo gairdneri*). Dev. Comp. Immunol. 6(3):481-489. (Dep. Microbiol. Med. Coll. Wisconsin, Milwaukee, Wis. 53226.).

A protein which reacts with the Cx-polysaccharide of *Streptococcus pneumoniae* and is inhibited by phosphorylcholine was isolated from the serum of rainbow trout by affinity chromatography. The protein, which exists in monomeric and oligomeric forms in nonimmune trout serum, is very similar with regard to specificity and size to the Cx-reactive protein from rabbits. A semi-quantitative analytical method for evaluating bacterial agglutination with an electronic particle counter and size distribution analyzer was developed to compare natural and acute serum levels of trout and rabbit Cx-reactive proteins. Results indicate that the poikilotherm has much higher concentrations in normal serum. The trout serum protein can also be rapidly induced to yet higher levels by both chemical and physical stress. The implications for such a protein in the teleost's natural defense system and overall homeostasis are discussed. (Authors).

002205.

000099

Wolf, K., Markiw, M. E.

1982. *Myxosoma cerebralis*: inactivation of spores by hot smoking of infected trout. Can. J. Fish. Aquat. Sci. 39(6):926-928. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

We processed 2-year-old rainbow trout (*Salmo gairdneri*) and brook trout (*Salvelinus fontinalis*) with clinical whirling disease, which is caused by *Myxosoma cerebralis*, in one of the following ways: iced, iced and brined, or iced, brined, and hot smoked at 66°C for 40 min. Skeletal elements of each group were added to tanks containing soil samples from an aquatic environment free of *M. cerebralis* and aged for 4 months at 12.5°C. Following this we assayed for infectivity by holding susceptible rainbow trout fry for 3 months in tanks of aquatic soil and skeletal elements. The fry were then examined for *M. cerebralis* spores. Spores were found in the fry from tanks that had received iced and iced and brined samples, but not in fry from tanks containing hot smoked tissue, healthy tissue, or no tissue–the last two being negative controls. (Authors).

002222.

000100

Wootten, R., McVicar, A. H.

1982. Some preliminary observations on proliferative kidney disease in wild brown trout, *Salmo trutta* L. in a Scottish stream. Bull. Eur. Assoc. Fish. Pathol. 2(4):60-62. (DAFS Mar. Lab. P.O. Box 101, Aberdeen AB9 8DB, Scotland.).

An epizootiological study of proliferative kidney disease in which evidence of the disease was found in wild fish in a stream supplying a trout hatchery. The wild fish are considered to be a possible reservoir of infection for the hatchery; accordingly, prospects for eradication are dismal. (Ken Wolf).

002178.

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THE DEPARTMENT OF THE INTERIOR

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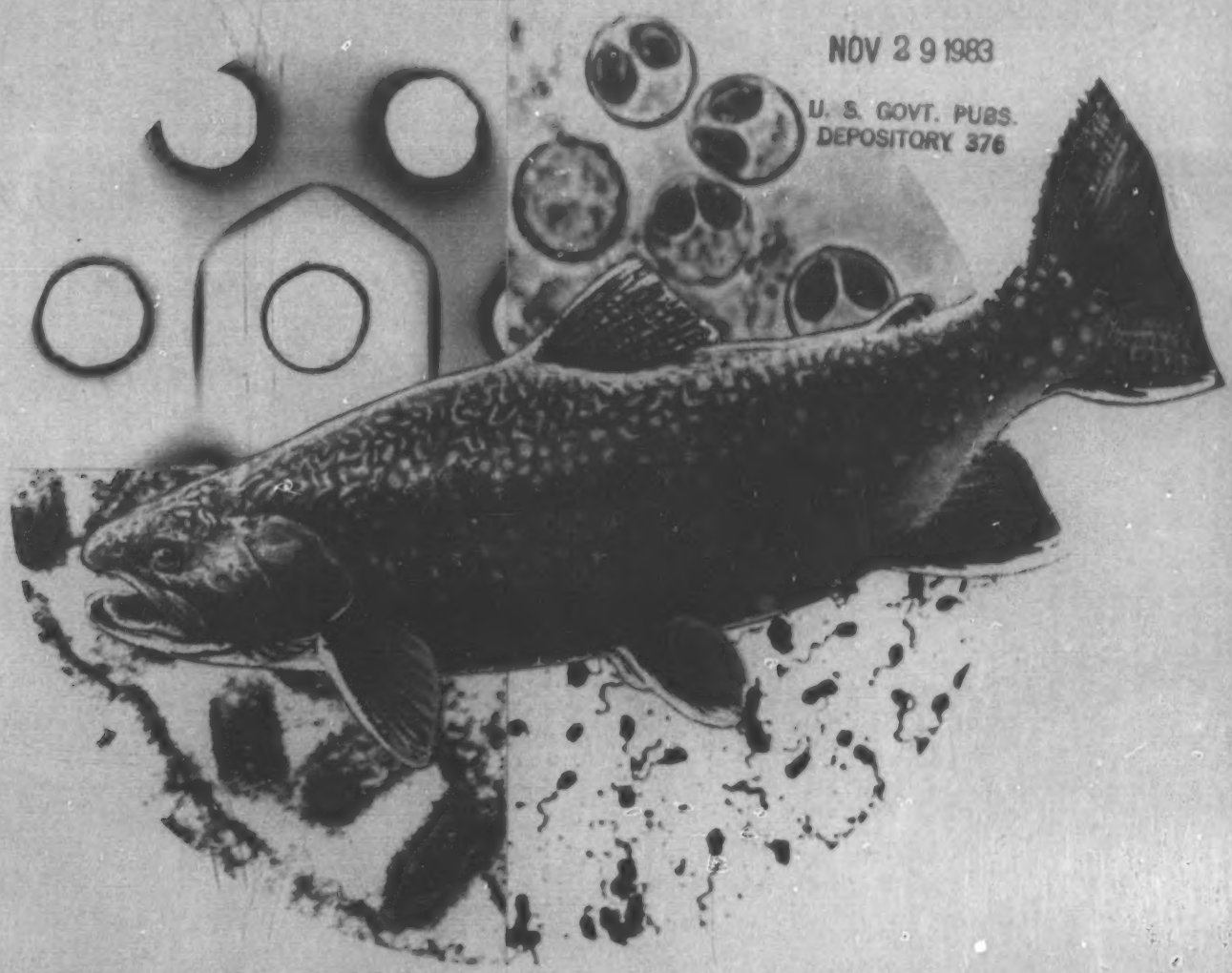

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REPORTS

Skin Myxoboliasis of a Major Carp (*Labeo rohita*) in Bangladesh

Abu Tweb A. Ahmed
Department of Zoology
University of Dhaka
Dhaka, Bangladesh

Recent cases of heavy myxosporean infection in the skin of fingerling *Labeo rohita* has caused serious concern among fish farmers. The infection is evident as milky white spots in the skin. The disease is prevalent during November to January in 6-9 cm T.L. fingerlings (3-4 months old). Under microscopic examination the white spots were found to be cysts containing spores of *Myxobolus* sp.

Labeo rohita is one of the three principal species of major carps reared for 3 to 4 years or more in polyculture. It is interesting to note that in polyculture of three species of carps, the skin myxoboliasis is restricted only to fingerlings, and at times the young of *L. rohita*. *Labeo rohita* is a midwater plankton feeder whereas the other two, *Catla catla* and *Cirrhina mrigala*, are surface and bottom dwellers respectively. Farmers rear these three economically important species in static water earthen ponds, with or without supplementary feeding with rice and wheat bran and organic and sometimes inorganic fertilization. Wide seasonal fluctuation of water levels occur in ponds.

Currently in Bangladesh, gill and skin involvement with myxoboliasis occurs at overall rates of about 50 and 40%, respectively. Moreover, these are the two protozoan diseases of greatest concern. However, very little is known about the taxonomy and biology of the myxosporeans. In an earlier publication we reported on gill myxoboliasis (Sanaullah and Ahmed 1980); however, the current work is the first report on skin myxoboliasis from this region. In contrast to *Myxobolus* that infects gills of all three major carp species, skin infection is observed only in fingerlings of *L. rohita*, and not in large fishes like the other two species. These characteristics might be related to food habits, age, and host specificity.

The disease is characterized by the appearance of milky white spots, except for the head and fins, scattered all over the body especially on ventrolateral surfaces (Fig. 1). The

Fig. 1. *Labeo rohita* fingerlings infected with skin *Myxobolus*. White cysts are evident in infected scale pockets.

spots appear to be much like initial lesions of fish pox, and in the corium are due to the presence of a large white cyst under the infected scale. The cysts are first evident in August and become abundant in the dry season during November to January. Infected scales are raised along their posterior margin and fall off when touched or rubbed. The cysts are shed with scales, and infected scales are noticeably thinner than normal scales. The fish, however, show no other abnormality; and the presence of *Myxobolus* spores does not debilitate the host. The fish, however, are rejected by the buyer.

The cyst is more or less round in shape but under microscopic examination usually shows six projections along the outer margin. Size of the cyst generally varies with size of the scale and can be as large as 5 mm in diameter. The cyst contains numerous oval spores, the anterior end is wider than the posterior end (Fig. 2). The sporoplasm contains large iodinophilous vacuole. The two oval polar capsules, located at the anterior end are equal in size and shape. The two amoebulae nuclei are also visible. Spores measure about 16 µm in length and 13 µm in width. Polar capsules are 7 X 4.5 µm.

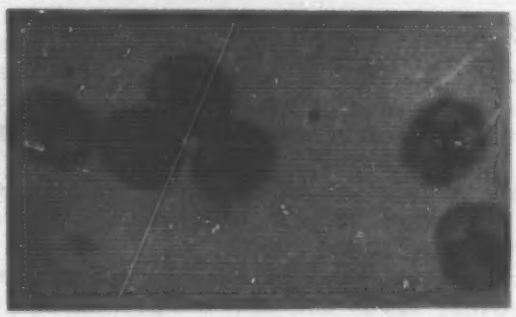

Fig. 2. Microphotograph of Giemsa stained mature spores of *Myxobolus* sp. from *L. rohita*. X 1800.

Kudo (1920) listed 10 species of *Myxobolus* from the integument of fishes, but their morphology, shape, and size are different from the present form. However, the present species has some affinities with *M. notemigoni* (Lewis and Summerfelt 1964), *M. sphericum* (Tripathi 1951), *M. mrigala* (Chakravorty 1939), *M. transovalis* (Gurley 1893), *M. insidiosus* (Wyatt and Pratt 1963), *M. barbi* and *M. indicum* (Tripathi 1951), *M. calbasu* (Chakravorty 1939), *M. darjagini* (Akhmerov 1954), *Myxobolus* sp. (Southwell 1915), and *M. gigas* (Auerbach 1906). The present species of *Myxobolus*, however, differs from those species in different biometric measurements and is believed to be a new species. Further studies are underway.

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Sanaullah, M., and A. T. A. Ahmed. 1980. J. Fish Dis. 3:343-354.

Southwell, T. 1915. Rec. Indian Mus. (Calcutta) 11:311-330.

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Wyatt, E. J., and I. Pratt. 1963. J. Parasitol. 49:951-955.

ISOLATION OF A REOVIRUS FROM CHANNEL CATFISH (*ICTALURUS PUNCTATUS*)

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Department of Medicine, School of Veterinary Medicine
University of California, Davis, California 95616

*Aquaculture Program, Department of Animal Science
University of California, Davis, Bodega Marine Lab
Bodega Bay, California 94923

In July 1982, at a fish farm in southern California,we isolated a virus from juvenile channel catfish (*Ictalurus punctatus*) (av wt 5 g) undergoing a chronic low level mortality (<5%). The virus was isolated from a pooled sample of liver, kidney, and spleen that was processed by standard methods (McDaniel 1979) and inoculated onto monolayers of channel catfish ovary (CCO) cells.

Cytopathic effects (CPE) were observed after 7 days at 26°C and were characterized by focal areas of syncytia that eventually involved the entire cell sheet (Fig. 1). In the final stages of change the cell sheet rolled up and detached from the substrate. Inoculation of fresh CCO monolayers with diluted culture fluids from affected cells resulted in the same CPE but in just 2 days.

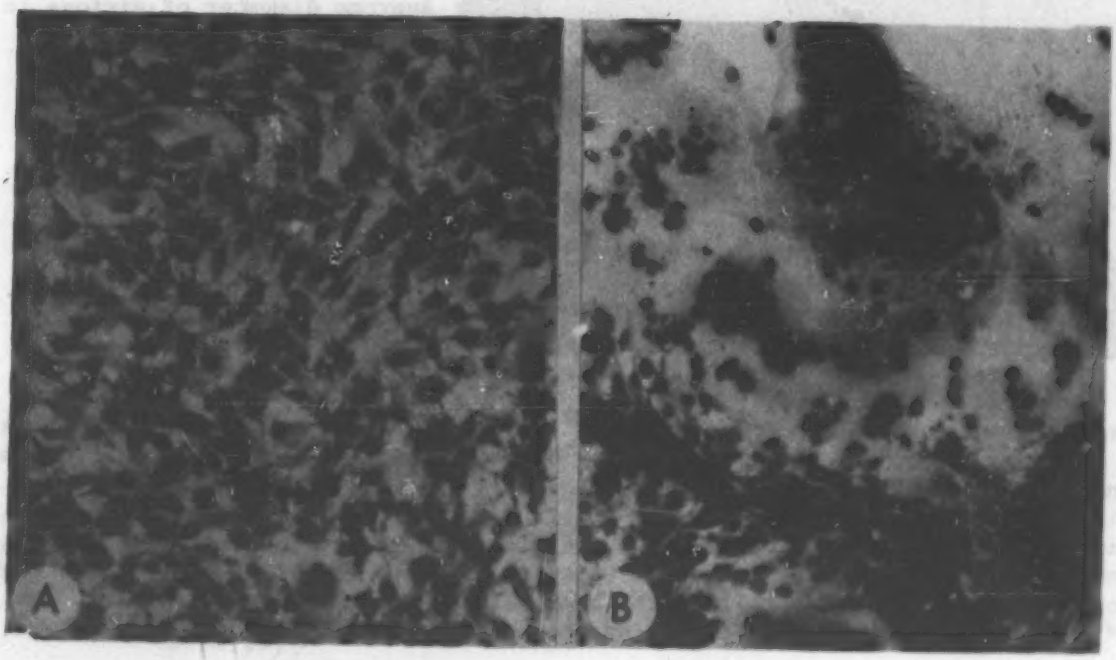

Fig. 1. Comparison of channel catfish ovary cells with and without the catfish reovirus. A. Uninfected control culture. B. Syncytia produced by catfish reovirus at 48 h at 26°C.

Accepted for publication 14 September 1983.

As evidenced by CPE, BB and CHSE-214 cells are susceptible to the virus, but the fathead minnow (FHM) cell line is refractory.

Hyperimmune rabbit antiserum prepared against channel catfish virus (CCV) failed to neutralize the new virus, and infectivity was not reduced by treatment with chloroform. In addition, replication of the virus was unaffected by 5-bromo-deoxyuridine. These results clearly indicate that the new virus is in no way related to channel catfish herpesvirus, the only other virus presently known from channel catfish (Plumb 1978).

Electron microscopy of partially purified virus from CCO cells demonstrated an icosahedron with double-shelled capsid morphology (Fig. 2) and 75 nm in size. The morphology and size is most similar to viruses of the family Reoviridae (Palmer and Martin 1982). We have determined that purified virions contain 11 segments of double-stranded RNA, and that finding further supports classification of this virus in the family Reoviridae. We propose the name catfish reovirus (CRV) for the new agent.

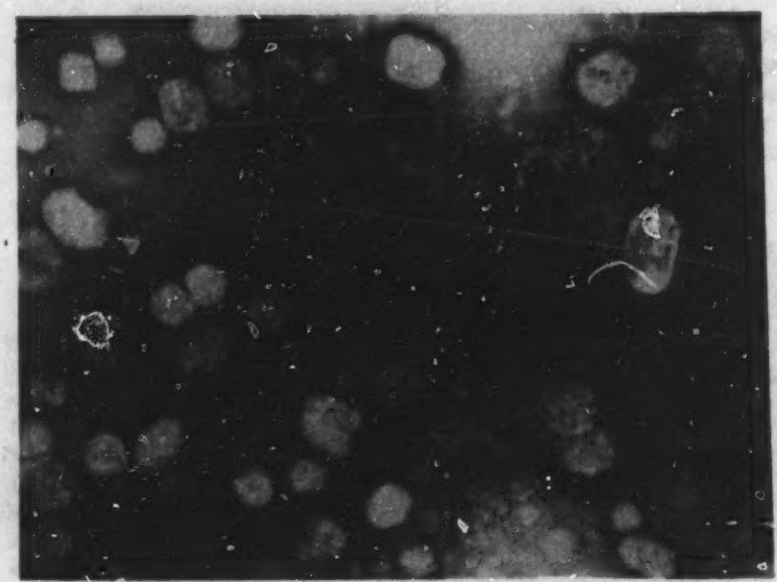

Fig. 2. Electron micrograph of partly purified catfish reovirus from channel catfish ovary cells. Average diameter of virions is 75 nm.

Effects of temperature on replication of CRV indicated that 25°C is optimal although growth did occur at 30°C. Virus grew poorly or not at all at 15, 20, and 35°C during a 96 h incubation period.

Infectivity trials were initiated with CRV in fingerling channel catfish using intraperitoneal injection and bath immersion. Results indicate the virus can replicate at 26°C for extended periods (up to 1 month) in catfish without causing mortality. In vivo effects of the virus at different temperatures or following stress are unknown.

Physical and biochemical properties of CRV are similar to those of a virus isolated by Plumb et al. (1979) from golden shiners (*Notemigonus crysoleucas*). Golden shiner virus (GSV), however shows a different host cell specificity, because it is replicated by FHM cells but not by CCO or BB lines. Interestingly enough, GSV is only partly neutralized by rabbit anti-CRV serum.

Viruses similar to CRV and GSV have been isolated from chum salmon (*Oncorhynchus keta*) by Winton et al. (1981) and from American oysters (*Crassostrea virginica*) by Meyers (1979). All four viruses share physical and biochemical properties suggesting that they belong to a new taxonomic group within the family Reoviridae.

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Palmer, E. L., and M. L. Martin, editor. 1982. An atlas of mammalian viruses. CRC Press, Inc., Boca Raton, Florida. 168 pp.

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Plumb, J. A., P. R. Bowser, J. M. Grizzle, and A. J. Mitchell. 1979. Fish viruses: a double-stranded RNA icosahedral virus from a North American cyprinid. J. Fish. Res. Board Can. 36:1390-1394.

Winton, J. R., C. N. Lannan, J. L. Fryer, and T. Kimura. 1981. Isolation of a new reovirus from chum salmon in Japan. Fish Pathol. 15:155-162.

BOOK REVIEW

Crosa, J. H., editor. 1983. Bacterial and viral diseases of fish--molecular studies. Washington Sea Grant, 3716 Brooklyn Ave., N.E., Seattle, Washington 98105. 86 pages.

The six papers in this volume summarize current molecular studies on the important bacterial and viral diseases of salmonids. The first paper details those diseases considered to be a major cause of mortality among cultured salmonids and also deals with methods for disease prevention. The focus turns next to the analysis of those bacterial and viral pathogens of fish in which the molecular aspects of the systems are fully documented. Thus, the three following papers analyze the causative agents of vibriosis and furunculosis. The molecular study of two viral systems, infectious hematopoietic necrosis (IHN) and infectious pancreatic necrosis (IPN) viruses is the subject of the last two papers.

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NEWS ITEMS

OBITUARY

Professor N. O. Christensen, Royal Veterinary Agricultural University, Copenhagen, Denmark, died of heart problems May 26, 1983 while hospitalized prior to having a pacemaker installed.

Professor Christensen was an internationally recognized authority on diseases of fishes. He authored the first Danish text on the subject and that book was later translated into French and other languages. He was the first President of the European Association of Fish Pathologists and, in that capacity, will be succeeded by Dr. Barry Hill, of Weymouth, England.

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THE JOURNAL OF WILDLIFE DISEASES

The Journal of Wildlife Diseases is now being printed at Allen Press and has a completely new format. Papers on various aspects of fish health and diseases are solicited. A research note/case report section is now available for shorter papers. For more details consult one of the latest copies. The new editor is Dr. Donald J. Forrester, College of Veterinary Medicine-IFAS, University of Florida, Gainesville, Florida 32611, USA.

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SALMON HATCHERY OUTBREAKS HAVE PATHOLOGISTS BAFFLED

An elusive new fish disease has appeared in two Oregon public salmon hatcheries.

The disease has fishery pathologists baffled, because although it resembles the virus known as VEN, the problem also could be caused by environmental conditions, said Richard Holt, head of the Oregon Department of Fish and Wildlife pathology division.

It first surfaced two years ago at the Fall Creek Hatchery, which is on a tributary of the Aslea River in central coastal Oregon. The hatchery raises fall chinook and coho salmon, and the disease had been named Fall Creek Syndrome. So far, it affects only hatchery coho.

Mr. Holt said VEN was found in extremely light levels, and that virus usually only affects chum stocks. The fish would be fed, and within 15 minutes some would begin to die. While the symptoms appeared to be stress related and the dead fish were anemic, there were no signs of anemia or stress in the population.

The disease did not appear at Fall Creek Hatchery in 1981, but it surfaced at the Nehalem Hatchery, some 80 miles north, at a very light level. There was no sign of the virus this year at Nehalem, but it reappeared at Fall Creek.

"We can't say for sure if it was the same thing," said Mr. Holt. The disease has caused losses of between four and six per cent at the two hatcheries.

The problem may be environmentally caused and the staff is checking for toxins in the bottoms of the rearing ponds. Changing fish diets did not arrest it.

A group of eggs collected from native coho in the Fall Creek system and reared in the hatchery last year (1981) were not affected and the problem did not appear in the fall chinook stocks.

Mr. Holt said a limited quarantine has been placed on the Fall Creek coho eggs, and they were not being distributed to river systems where they had not been previously released.

P. Hjul, Editor
Fish Farming International. 1983.
10(1):4.

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Anemic Condition in Cultured Channel Catfish

The following letter was received from E. W. Shell, Dep. Head, Fisheries and Allied Aquacultures, Auburn University, Alabama 36849, USA.

Since early May 1983 a severe anemic condition has been observed in cultured channel catfish in Alabama and to a lesser extent in Georgia. Approximately 50 cases have been reported from Alabama. The number of deaths within an affected population has been low; however we do not know the incidence of anemia in the surviving fish. In most instances less than 5% of the fish have died.

The actual blood cell volume in the anemic fish is reduced by 85% to 97% of that in a healthy catfish; consequently the blood may be light red or clear when the fish is cut. Due to the lack of blood cells in the fish, the gills of anemic fish are pale, almost white; while the liver is white to yellow or light brown. The spleen is pink rather than dark red, and the kidney is pale. The intestine is generally white, but it may have a reddish color. There may be a watery fluid in the stomach.

Examination of affected fish has not revealed viruses, bacteria or parasites to be the primary cause of the anemic condition; therefore we do not believe that an infectious agent is involved. Analysis of feeds has shown that aflatoxins, pesticides or lead were not present in significant quantities to be harmful to the fish. At the present time we do not know the primary cause of the anemic condition in cultured catfish, but we are continuing to investigate the problem.

INTERNATIONAL SYMPOSIUM

An international symposium on salmonid reproduction will be held in Seattle, Washington, October 31-November 2, 1983. Organized to facilitate information exchange among researchers in applied and basic areas of salmonid reproduction, the symposium has attracted participants from Canada, Japan, several European countries, Australia, the USSR, the People's Republic of China, and the United States.

More than 80 papers have been scheduled for sessions on five areas important to current salmonid research and management: genetics, endocrinology, nutrition, environmental factors, and brood stock husbandry. The scheduled speakers represent federal and state/provincial management agencies, university research laboratories, and several private aquaculture and consulting firms.

All papers--both oral and poster--are eligible for publication in either Aquaculture or in a proceedings to be published by the Washington Sea Grant Program. Each of these volumes will be a special issue devoted exclusively to the Symposium. One copy of the proceedings published by Washington Sea Grant will be provided to every Symposium participant who pays a full or limited registration fee. The proceedings to be published by Aquaculture will be available to Symposium registrants at a cost to be determined by the publisher.

For additional information, contact

Salmonid Reproduction Symposium
Washington Sea Grant Program
3716 Brooklyn Avenue NE
Seattle, Washington 98105 USA

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FISH HEALTH MANAGEMENT COURSE

A course in practical Fish Health Management will be conducted by Haywood Technical College, Clyde, North Carolina, 20-24 February 1984. BioMed Research Laboratories (Seattle, Washington) and Zeigler Brothers (Gardners, Pennsylvania) are co-sponsoring the course. Instruction is designed to give trout growers basic information needed to maintain a practical fish health management program.

Included in the course are: basic prevention of infectious and noninfectious diseases, field recognition of health problems, handling disease outbreaks, treatment calculations and applications, and an introduction to the use of computers in fish farm management. "Hands on" fish health evaluation will be held during lab and field sessions.

The instructor will be Dr. G. W. Klontz, Professor of Fisheries, University of Idaho.

A registration fee of $10.00 will be charged. For more information or to register, contact

Charles W. Johnson
Fishery Training Specialist
Haywood Technical College
Clyde, North Carolina 28721

Telephone: 704/627-2821

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WARMWATER FISH DISEASE SHORT COURSE

A short course, "Diagnosis and Treatment of Diseases of Warmwater Fish" will be taught at Mississippi State University 14-25 May 1984.

The course provides instruction in the methodology of diagnosis and treatment of parasitic, bacterial, viral, nutritional, and environmental diseases of warmwater fish. Undergraduate or graduate credit of four semester hours is given for successful completion. Tuition if $176.00, subject to change.

The course is limited to 24 persons, and applications must be received on or before 1 March 1984. Persons interested in taking the course should apply by writing to Dr. Thomas L. Wellborn, Jr., P. O. Box 5405, Mississippi State, Mississippi 39762 USA. All applicants will be advised whether or not they have been accepted to attend before 1 April 1984.

Students will be expected to provide their own compound microscope and dissecting kit. However, a limited number of microscopes will be available for those people who do not have one.

Instructors for the course will be Dr. Thomas L. Wellborn, Jr., Leader, Wildlife and Fisheries Department, Mississippi Cooperative Extension Service, Mississippi State University; Dr. T. E. Schwedler, Area Fisheries Specialist, Stoneville, Mississippi, and Dr. J. R. MacMillan, Area Fisheries Specialist, Stoneville, Mississippi.

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FINFISH AQUACULTURE CONFERENCE

Brigham Young University--Hawaii Campus--has announced that it will hold its 2nd International Conference on Warm Water Aquaculture-Finfish, 5-8 February 1985. The following topics will be included:

- Hatchery Technology and Larval Biology
- Maturation, Spawning and Breeding
- Nutrition, Feeds and Feeding Practices
- Diseases and Predators
- Growout Management Techniques and Water Quality
- Production Economics and Marketing
- Government Supports and Attitudes
- Legal Aspects

Persons intending to participate are advised that abstracts must be submitted on an official abstract form by 1 June 1984. Abstract forms and further information are available from

Warm Water Aquaculture Conference
Box 1770
Brigham Young University-Hawaii Campus
Laie, Hawaii 96762

Attention: Prof. T. Aaron Lim

Telephone 808/293-3804

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LIBRARY ACCESSIONS

000001

Agrawal, N. K., Mahajan, C. L.

1983. Hematological and hematopoietic studies in pyridoxine deficient fish, *Channa punctatus* Bloch. J. Fish Biol. 22(1):91-103. (Aquat. Fish Biol. Lab. Dep. Zool. Univ. of Rajasthan, Jaipur, India.).

Pyridoxine deficiency was induced in a population of *Channa punctatus*. The deficiency effects were increased by adding 4-deoxypridoxine as an antagonist. Hematological and hematopoietic changes were studied. The significant changes in peripheral blood appeared after 150 days in the antagonist treated group and 180 days in the group on the deficient diet. After 240 days when morphological changes and an increased mortality also appeared, the changes in RBC and related values (hemoglobin, hematocrit, MCV, MCH, and MCHC) were highly significant and indicated hypochromic microcytic anemia; this was accompanied by leukopenia. The hematopoietic studies revealed significant increase in the earlier stages of erythrocytic development (basophilic erythroblasts and polychromatophilic erythroblasts) with a simultaneous decrease in the later stages (young and mature reticulocytes). A series of pathological disorders in the various developing cells were recorded in the imprints of hematopoietic tissues. The pyridoxine specificity of these changes was confirmed by remedial treatment for a month. (Authors).

002319.

000002

Ahne, W.

1981. Important viral diseases in European fish cultures. Pages 19-35 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Inst. Zool. Hydrobiol. Univ. Munich, Kaulbachstr. 37 D-8000 Munchen 22, Fed. Rep. Germany.).

Four viral diseases cause economic loss in European fish culture: infectious pancreatic necrosis of trout (IPN), spring viremia of carp (SVC), viral hemorrhagic septicemia of trout (VHS). Two diseases occur in carp populations which may have a viral etiology: *Epithelioma papillosum* of carp, gill necrosis of carp. The causative agents, the pathological signs of the fish as well as control and diagnosis of the diseases are described. (Authors).

002361.

000003

Amend, D. F., Conte, F. S.

1982. Disinfection: necessary preventive maintenance for healthy fish. Aquacult. Magazine, 9(1):25-27, 29. (Dep. Med. Sch. Vet. Med. Univ. California, Davis, Calif. 95616.).

Written for the hatchery manager/owner. The authors present and further explain five principles or commandments of hatchery hygiene, sanitation, and disinfection. (Ken Wolf).

002327.

000004

Anderson, D. P., Dixon, O. W.

1981. Fish biologics: antisera for fish disease diagnosis. Pages 412-424 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

The production and distribution of biologics used for detection, identification, and prevention of fish disease agents has enabled serodiagnostic methods and immunization to become valuable tools for fish pathologists. The immunization regimens, including schedules of antigen exposure, doses, and choice of adjuvant used for rabbits or other animals, may differ for the particular disease agents. The quality of the final antisera may be dependent not only on titer, but on the presence of cross-reactive antibody. This paper outlines some of the

procedures used for antisera production at the National Fish Health Research Laboratory. (Authors).

002394.

000005

Andrews, C., Riley, A.

1982. Anthelmintic (sic) treatment of fish via stomach tube. Fish. Mgmt. 13(2):83-84. (Yorkshire Water Authority, Olympisa House, Gelderd Road. Leeds LS12 6DD, Yorks.).

Tubes were made from veterinary dog or horse catheters that were cemented to disposable syringes. Praziquantel (Droncit, Bayer) was delivered to anesthetized fish at a final dosage of about 27-34 mg/kg body weight. Four silurid catfish and 74 cyprinids were treated twice, but expulsion of cestodes was mentioned only from the catfish. Emphasis is on the equipment. (Ken Wolf).

002291.

000006

Anyanwu, A. O.

1983. Parasitic infestations of *Pseudotolithus* spp. off the coast of Lagos, Nigeria. J. Fish Biol. 22(1):29-33. (Nigerian Inst. Oceanogr. Mar. Res. P. M. B. 12729, Victoria Island, Lagos, Nigeria.).

A nematode parasite *Philometra translucida* Walton (1927) was found in the ovaries of *Pseudotolithus senegalensis*, *P. typus*, and *P. elongatus* abundant and commercial sciaenid species. The parasite measured 56.0-59.0 cm in length. It occupied one-third to two-thirds of the mesenteries of the matured ovaries in severe cases of infection. The incidence of infestation, highest during peak spawning, was 10.0% in *P. senegalensis*, 12.0% in *P. typus* and 20.0% in *P. elongatus*. Another nematode parasite *Contracaecum* sp. Ralliet & Henry (1912) was observed in the ovaries of two specimens of *P. typus*. (Author).

002314.

000007

Aoki, T., Kitao, T., Iemura, N., Mitoma, Y., Nomura, T.

1983. The susceptibility of *Aeromonas salmonicida* strains isolated in cultured and wild salmonids to various chemotherapeutics. Bull. Jpn. Soc. Sci. Fish. 49(1):17-22. (Dep. Fish. Fac. Agric. Miyazaki Univ. Miyazaki 880 Japan.).

One hundred and seventy-five strains of *Aeromons salmonicida* isolated in cultured salmonid fish and wild salmonid fish were tested for their susceptibility to 12 chemotherapeutics. Five of 129 isolated strains were sensitive to all the drugs tested. The remaining 124 strains were resistant to from one to six drugs; in particular, nalidixic acid derivatives and/or nitrofuran derivatives. Transferable R plasmids were detected in only two out of 124 resistant strains. The resistant marker of the detected R plasmids determined as a combination of chloramphenicol (CM), streptomycin and sulfonamides (SA). The molecular weight of the R plasmids was 29 M daltons. Non-transferable R plasmids resistant to TC were detected in two *A. salmonicida* strains harboring transferable R plasmid and had a molecular weight of 7.6 M daltons. On the other hand, 32 strains isolated in wild salmonid fish were sensitive to all the drugs tested. The remaining strains were resistant to SA, and to a combination of CM, colistin and SA. These resistant strains had no transferable R plasmids. (Authors).

002324.

000008

Arthur, J. R., Margolis, L., Whitaker, D. J., McDonald, T. E.

1982. A quantitative study of economically important parasites of walleye pollock (*Theragra chalcogramma*) from British Columbian waters and effects of postmortem handling on their abundance in the musculature. Can. J. Fish. Aquat. Sci. 39(5):710-726. (Dep. Fish. Oceans, Fish. Res. Branch, Pacific Biol. Stn. Nanaimo, B. C. Canada V9R 5K6.).

The identity of parasites infecting the musculature and body cavity (including external surfaces of viscera) of walleye pollock (*Theragra chalcogramma*) collected from two British Columbian localities, their distribution within the host's musculature, and the influence of host sex, length, and method of postmortem handling on parasite prevalence and abundance were determined. (Authors).

002267.

000009

Austin, B., Johnson, C., Alderman, D. J.

1982. Evaluation of substituted quinolines for the control of vibriosis in turbot (*Scophthalmus maximus*). Aquaculture 29(3,4):227-239. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth, Dorset DT4 8UB, England.).

From a comparison of 103 compounds, the usefulness of substituted quinolines, in particular 5,7-dichloro-8-hydroxyquinoline, 5, 7-dichloro-8-quinolyl-N-phenylcarbamate, Halquinol and oxolinic acid, have been indicated for the control of vibriosis in turbot (*Scophthalmus maximus*). From in vitro and in vivo experiments, it was deduced that these chemicals inactivated rapidly the bacterial isolates, and controlled the disease manifestation in fish. (Authors).

002273.

000010

Austin, B., Rayment, J., Alderman, D.J.

1983. Control of furunculosis by oxolinic acid. Aquaculture 31(2):101-108. (Ministry of Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth, Dorset DT4 8UB, England.).

From a comparison of 50 antimicrobial agents, the usefulness of oxolinic acid was indicated for the control of furunculosis in brown and rainbow trout. From in vitro and in vivo experiments, it was deduced that oxolinic acid rapidly inactivated the bacterial cells, and controlled the disease manifestation in fish. (Authors).

002343.

000011

Axelrod, H. R.

1983. Your fishes' health: curvature of the spine. Trop. Fish Hobbyist 31(7, 325):42,43,46. (T. F. H. Publ. Inc. 211 W. Sylvania Ave. Neptune City, N. J. 07753.).

Lordosis of tropical fishes–an abnormality due in some cases to genetic factors but in others a result of nutritional factors–is described and illustrated for the hobbyist. (Ken Wolf).

002320.

000012

Baker, R. J., Knittel, M. D., Fryer, J. L.

1983. Susceptibility of chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), and rainbow trout, *Salmo gairdneri* Richardson, to infection with *Vibrio anguillarum* following sublethal copper exposure. J. Fish Dis. 6(3):267-275. (U. S. Environ. Prot. Agency, Corvallis Environ. Res. Lab. Freshw. Div. Corvallis, Ore. 97330.).

Chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), and rainbow trout, *Salmo gairdneri* Richardson, were used to determine if sublethal copper exposure would increase their susceptibility to *Vibrio anguillarum* infection. Fish were pretreated with copper at fractional levels of the 96 h copper LC_{50} before exposure to the pathogen. Mortality by vibriosis was greater among fish exposed to 9% of the copper LC_{50} for 36 h than unexposed fish. Peak susceptibility to vibriosis depended in part on the interaction of exposure time and copper concentration. The higher copper concentrations produced peak susceptibility to infection in shorter time periods. After the peak of susceptibility, sensitivity to infection declined to near control levels in those fish where exposure was continued. Rainbow trout stressed by copper required about 50% fewer pathogens to induce a fatal infection than non-copper exposed fish. (Authors).

002355.

000013

Bauer, O. N.

1981. Dermocystidium infections of cultured fishes. Pages 198-204 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Zool. Inst. USSR Acad. Sci. Leningrad B 164, USSR.).

A survey of Dermocystidium infection of cultured freshwater fishes is given. It is noted that several species of these may act as pathogens causing disease of gills and skin. There are five species infecting carps of young age. The systematic position of Dermocystidium is not clear and features used as species criteria are rather poor. The genus needs further studies using new methods such as electron microscopy. (Author).

002375.

000014

Bekesi, L., Kovacs-Gayer, E., Pusztay, M., Csaba, G.

1981. Studies on gill necrosis complex. Pages 461-465 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Cent. Vet. Inst. 1851 Budapest, Tabornok u. 2. Hungary.).

In judgement of gill necrosis there is a difference between the opinion of Hungarian pond culturists and that of international literature. Almost every change of gill is considered gill necrosis. In order to end this situation extensive studies have been carried out and the results are summarized: (1) Laboratory analysis is essential to diagnose the disease; (2) In pathology of gill necrosis primary and secondary causes can be differentiated. The typical necrosis was described as ammonia in or autotoxication; (3) Concerning virus etiology neither evidence has been found, nor positive result gained in experimental infections with *Flexibacter* and *Aeromonas*; (4) The damage of gill can be prevented by using improved complex technology of production and hygiene. Although treatment with chlorine-lime cannot eliminate the cause of the disease, losses can be repressed under a certain level acceptable from economical viewpoint. (Authors).

002398.

000015

Bekesi, L., Kovacs-Gayer, E., Ratz, F., Turkovics, O.

1981. Skin infection of the sheatfish *Silurus glanis* L. caused by a herpes virus. Pages 59-69 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hunary. 23-27 Jun. (Cent. Vet. Inst. 1581 Budapest, Tabornok u. 2. Hungary.).

Pox-like epidermal changes were found in sheatfish population kept in net-cage system. The pathology was identical to that Lucky first described in 1970, but acidophilic inclusion bodies, Cowdry-A, and several acidophilic autophage vacuoles were also seen in the cytoplasm of the altered epithelial cells. In the nuclei and cytoplasm of these cells herpes-like virus particles were detected by electron microscopy. (Authors).

002365.

000016

Berland, B.

1983. Redescription of *Cucullanus elongatus* Smedley, 1933 (Nematoda: Seuratoidea) from the lingcod *Ophiodon elongatus* Girard, 1854 from the Pacific coast of Canada. Can. J. Zool. 61(2):385-395. (Zool. Lab. Univ. Bergen, Allegaten 41, N-5000 Bergen, Norway.).

Cucullanus elongatus Smedley, 1933, from the intestine of the lingcod *Ophiodon elongatus* Girard, 1854, caught off Vancouver Island, B. C. Canada, is redescribed and illustrated. The fine morphology of the head and pseudobuccal capsule is described and depicted in some detail, with functional considerations. (Authors).

002321.

000017

Blasiola, G. C.

1982. Fish diets: nutrition is key to health. Pet Age 11(12):41-44. (Manager, Marketing Dep. Pet-Aquatic Group, Oasis/Kordon, Hayward, Calif. 94544.).

A popular account for the tropical fish hobbyist. Discussion includes the importance of supplemental feeding with natural foods, the interplay of nutrition and disease, and storage of dry feeds. (Ken Wolf).

002285.

000018

Boyadziev, N.

1981. Possibilities for enhancing the organospecific value of enzyme diagnostics in the trout *Salmo gairdneri*. Pages 332-340 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Inst. Forestry, Hristo Botev Bl 18/1006, Sofia 85, Bulgaria.).

It was established by studies on SGOT and SGPT of 659 rainbow trout living in karst water at

S-415085 0004(00)01-SEP-83-17:20:54)

a definite nutrient regime, that serum glutamate-oxalacetate-transaminase and glutamate-pyruvate-transaminase differ in the various age groups of trout. The highest values were assessed in 2-year-old males. The highest mean SGOT and SGPT activity was observed in all age groups during the winter. The lowest SGOT activity was assessed in the summer, while the lowest SGPT activity in autumn. (Author). (Paper in Russian).

002387.

000019

Braun-Nesje, R., Kaplan, G., Seljelid, R.

1982. Rainbow trout macrophages in vitro: morphology and phagocytic activity. Dev. Comp. Immunol. 6(2):281-291. (Inst. Med. Biol. Univ. Tromso, Norway.).

The properties of macrophages from the pronephros of rainbow trout (*Salmo gairdneri* Richardson) were studied in vitro. We found that phagocytes obtained from the pronephros constitute a nonhomogeneous cell population. Three populations with different adherence properties were examined with special emphasis on morphology and phagocytic capacity. The differentiation of the three populations in culture was similar morphologically, and their phagocytic activity showed only small variations. The methods for cell separation and culture reported here are a useful tool for gaining better understanding of how rainbow trout macrophages function in the immune response. (Authors).

002270.

000020

Bucsek, J. M., Csaba, G.

1981. Ultrastructural observations on a carp blood parasite of uncertain taxonomic position. Pages 210-221 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Cent. Vet. Inst. 1581 Budapest, Tabornok u.2. Hungary.).

Authors present the ultrastructure of a protozoon living in carp fry blood. This protozoon has been investigated on several occasions with light microscope by Soviet authors and they described it as *Hemogregarina cyprini*. The protozoon studied in this paper seems to be the same, but because of the absence of certain cellular organelles and its extracellular occurrence it may not be a member of Hemogregarinae. (Authors).

002377.

000021

Chen, S. N., Ueno, Y., Wen, S. C., Kou, G. H.

1983. Establishment of a cell line from kidney of tilapia. Bull. Eur. Assoc. Fish Pathol. 3:1-4. (Dep. Zool. Natl. Taiwan Univ. Taipei, Taiwan.).

A cell line, TK-1, was established from kidney of tilapia hybrid using Leibovitz's medium L-15 (L-15) plus 10% fetal calf serum (FCS) at 31°C. The cells have been passed for 140 times since its initiation in 1981. TK-1 cells grew best at an incubation temperature of 31°C. The growth of cells varied in L-15 with different concentrations of FCS, L-15 and RPMI-1640 supplemented with 10% FCS supported the growth of cells. However, no growth was observed in MEM or M-199 plus 10% FCS. The cell line was demonstrated to be free of bacteria, fungus and mycoplasma contaminations. TK-1 cells are susceptible to four tested fish viruses including EVE, EVA, EVEX and IPNV. (Authors).

002349.

000022

Chilmonczyk, S., Monge, D.

1982. Rainbow trout lymphoid organs: cellular effects of corticosteroids and anti-thymocyte serum. Dev. Comp. Immunol. 6(2):271-280. (Inst. Natl. Res. Agronomique, (INRA), Lab. Ichtyopath. Route de Thiverval, 78850, Thiverval-Grignon, France.).

Cellular populations were studied in lymphoid organs of rainbow trout. Kidney appeared to be the most important organ by the number of cells harvested. A high percentage of peroxidase positive cells was measured in kidney, spleen and blood. The use of cortisone and rabbit anti-thymocyte serum showed differences in ratio of sensitive cells from different organs. In fish treated with steroids, cell depletion was verified in each organ but histologic lesions were observed only in thymus. Rabbit anti-thymocyte serum was cytotoxic for the quasi-totality of thymocytes while it destroyed only a part of kidney, spleen and blood cells. No correlations could be made between ster-

oid sensitive cells and anti-thymocyte serum sensitive cells. (Authors).

002271.

000023

Cipriano, R. C.

1983. Resistance of salmonids to *Aeromonas salmonicida*: relation between agglutinins and neutralizing activities. Trans. Am. Fish. Soc. 112(1):95-99. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

Serum of furunculosis-resistant rainbow trout *Salmo gairdneri*, when injected into brook trout *Salvelinus fontinalis*, increased resistance of the brook trout to virulent challenges of *Aeromonas salmonicida*, the furunculosis pathogen. Serum from susceptible Atlantic salmon *Salmo salar* did not confer passive resistance on brook trout although natural agglutinin titers in Atlantic salmon serum were equal to those in rainbow trout. Further analyses indicated that rainbow trout serum neutralized toxic components produced by *A. salmonicida*, but that Atlantic salmon serum did not. When 11 strains of rainbow trout were challenged with 10^8 virulent cells of *A. salmonicida*, a range of mortality from 0 to 83% resulted. Although no correlation was observed between the natural serum agglutinin level of a particular strain and its relative resistance to experimental pathogen challenge, an inverse relation was apparent between cytotoxic serum-neutralization activity and resistance to furunculosis. (Author).

002328.

000024

Coley, T. C., Chacko, A. J., Klontz, G. W.

1983. Development of a lavage technique for sampling *Ceratomyxa shasta* in adult salmonids. J. Fish Dis. 6(3):317-319. (Northwest and Alaska Fish. Cent. Natl. Mar. Fish. Serv. Natl. Oceanic Atmos. Admin. Seattle, Wash. 98104.).

A syringe fitted with an improvised flexible plastic catheter is used to sample materials suspended in physiological saline within the lumen of the intestine. Detection rates of 95% are reported for this nondestructive technique. (Ken Wolf).

002360.

000025

Cone, D. K., Wiles, M.

1983. Comparative morphology of *Gyrodactylus groenlandicus* Levinsen, 1881, *G. nainum* Hanek and Threlfall, 1970, *G. pleuronecti* Cone, 1981, and *G. adspersi* sp. n. (Monogenea) from northwest Atlantic fishes. Can. J. Zool. 61(2):417-422. (Biol. Dep. Saint Mary's Univ. Halifax, N. S. Canada B3H 3C3.).

The four gyrodactylids were compared morphologically and found to differ. Measurement data are given as is a discussion of possible evolutionary relationships between the four. (Ken Wolf).

002323.

000026

Csaba, G., Kormendy, B., Bekesi, L.

1981. Observations on the causative agent of carp erythrodermatitis in Hungary. Pages 95-110 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Cent. Vet. Inst. 1581 Budapest, Tabornok u. 2. Hungary.).

More than 30 isolates of the carp erythrodermatitis (CE) agent were obtained from various Hungarian fish farms. Successful isolations were primarily carried out from the peripheral area of ulcers on blood agar. Then liquid medium cultures after 72 hours of incubation were used for experimental inoculations into the scarified skin of carp using needles. Infected carp showed characteristic dermatitis 5-6 days later. There were either ulcers, or small papulas with hyperemic margins on the sites of inoculation, and the central area of the latter was often necrotic. Similar results were obtained following experimental infection into the damaged fins. The pathogenic agent was easily reisolated from lesions. These CE agents seemed to belong to the *Aeromonas* genus of Vibrionaceae. More exactly, their bacteriological properties mainly corresponded to those of *Aeromonas salmonicida* with some small differences from its subspecies. (Authors).

002367.

000027

Csaba, G., Frigli, M., Bekesi, L., Kovacs-Gayer, E., Bajmocy, E. Fazekas, B.

1981. Septicemia in silver carp *Hypophthalmichthys molitrix*, val. and bighead *Aristichthys nobilis*, Rich. caused by *Pseudomonas fluorescens*. Pages 111-123 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Cent. Vet. Inst. 1581 Budapest, Tabornok u. 2, Hungary.).

Authors observed *Pseudomonas fluorescens* septicemia in silver carp and bighead with heavy mortality in winter ponds during 1978-1981. There were bleedings in the skin, fins, in the mouth, and internal organs, accompanied by anemia. The planktonophagous fishes were kept together with carp in wintering ponds, but the carp did not became ill. After experimental infection with bacteria isolated from ill fish, bleeding also appeared all over the planktonophagous fishes and they died as a result of infection. The carp were infected by the same bacteria, but they did not react to the infection. The most important characteristics of the isolated bacteria were studied. It was found that bacteria grew well at 4°C, and they were capsulated both in culture and in organs of fish. Stress factors seem to play an important role in the pathogenesis of this disease. (Authors).

002368.

000028

de Kinkelin, P., Dorson, M., Hattenberger-Baudouy, A. M.

1982. Interferon synthesis in trout and carp after viral infection. Dev. Comp. Immunol. Suppl. 2:167-174. (I.N.R.A. Lab. Ichtyopathol. Route de Thiverval, 78850 Thiverval-Grignon, France.).

Circulating interferon (IFN) was induced in subadult rainbow trout by the injection of viral hemorrhagic septicemia virus (VHSV) which was further destroyed by heating the collected serum. This serum or its light fractions from sucrose gradient with IFN activity were injected into fry exerting a subsequent protective effect against experimental water route infection performed either with VHSV or with IPNV. It is suggested that in natural VHS the kinetics of IFN synthesis could account for the temperature dependence on the clinical VHS. In carp, circulating IFN has been demonstrated following experiment infection with spring viremia of carp virus but its protective effect has not been shown despite the temperature dependence of SVC which could be substantiated by that of the IFN kinetics of production. (Authors).

002274.

000029

Dixon, P. F., Hill, B. J.

1983. Rapid detection of infectious pancreatic necrosis virus (IPNV) by the enzyme-linked immunosorbent assay (ELISA). J. Gen. Virol. 64:321-330. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth, Dorset DT4 8UB, England.).

The enzyme-linked immunosorbent assay (ELISA) was used to demonstrate IPNV antigen. Antigen could be detected in cultures before CPE was evident. Cultures showing complete CPE produced intense color reactions. Antigen was detected in fry during and immediately after an epizootic, but although IPNV-carrier fish could be detected, the sensitivity was not as great as that of isolation. Infectious pancreatic necrosis serotypes, Sp, Ab and Vr, cross-reacted at only a low level and it was shown that the ELISA technique could be used to serotype IPNV strains rapidly. None of 10 other viruses reacted with plates sensitized for IPNV detection. Time to perform the technique was 1 h 35 min at room temperature and this still allowed the results to be readily assessed visually. (Authors).

002310.

000030

Do, T. T., Kasahara, S.

1982. *Humphreysia hoi* sp. nov. (Copepoda: Poecilostomatoida, Chondracanthidae) parasitic on the gills of *Parapercis sexfasciata* (Temminck & Schlegel) (Pisces: Teleostei, Parapercidae), with description of first male of the genus. Fish Pathol. 16(4):157-162. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama 720, Japan.).

Humphreysia hoi sp. nov. is described based on the specimens collected from the gill filaments of *Parapercis sexfasciata* (Temminck & Schlegel), caught in Kojima Bay, Japan. It can be easily differentiated from the type-species, *H. floreata* Leigh-Sharpe, 1934, on the body shape, first antenna, and oral appendages. The male is described for

the first time in the genus, its claw-less maxilliped is unique in the Chondracanthidae. (Authors).

002298.

000031

Egusa, S.

1982. A microsporidian species from yellowtail juveniles, *Seriola quinqueradiata*, with 'Beko' disease. Fish Pathol. 16(4):187-192. (Fish Dis. Lab. Nippon Vet. Zootech. Coll. Kyonan-cho, Musashino City, 180 Japan.).

A microsporidian species which invades the trunk muscle of yellowtail juveniles (*Seriola quinqueradiata*) and causes 'Beko' disease was studied. The parasites appeared as multiform masses in cross sections of the muscle and usually elongated masses in longitudinal sections. The masses were bounded externally by a host-produced fibrous membrane. Almost all the parasites clearly represented stages in the sporulation sequence. Sporogony was believed to occur by multiple fission of sporogonial plasmodia. Sporocyst, sporogony vacuole and pansporoblast membrane were absent. The diplocaryon was not confirmed in any sporulation stage. Fresh spores were ovoid and measured 2.9-3.7 X 1.9-2.4 µm and had a coiled polar tube within the spore membrane. Extruded polar tubes were 44-52 µm in length. This species could not be classified in any established genus and therefore it seemed appropriate to place it provisionally in the collecting group *Microsporidium*. The name *M. seriolae* was proposed. (Author). (Paper in Japanese).

002306.

000032

Elger, M., Hentschel, H.

1983. Glomerular disease in cultured rainbow trout, *Salmo gairdneri* Richardson, suffering from presumptive chronic viral hemorrhagic septicemia. J. Fish Dis. 6(3):211-229. (Inst. Zool. Tierdrztliche Hochschule, Hannover, D-3000 Hannover, Fed. Rep. Germany.).

Severe glomerular changes in the kidney of rainbow trout suffering from presumptive chronic viral hemorrhagic septicemia are described. The pathological changes, as revealed by light- and electron microscopy, resembled those of membranous glomerulonephritis in mammals. Large electron-dense subendothelial-mesangial deposits were present in most glomeruli. A lattice-like arrangement of macromolecules was observed. Monocytes and macrophages were observed in the capillary convolute. The possibility of post-infectious disease nephropathy with aggregation of immunocomplexes in the capillary wall in fishes is discussed. (Authors). Editor's note: Virus isolation was attempted but no agent was isolated.

002351.

000033

Eveinberg, D., Bootsma, R., Lugtenberg, B.

1981. Detection, purification and characterization of a major cell envelope protein, related to virulence, of autoagglutinating *Aeromonas salmonicida* strains. Soc. Gen. Microbiol. Q. 8(4):253-254. (Inst. Mol. Biol. Univ. Utrecht, The Netherlands.).

We hypothesize that the major cell envelope protein found in autoagglutinating strains is the (main) subunit of the additional cell surface layer. We designated this protein as the additional cell envelope protein or ACE protein. The application of the gel immuno-radioassay, an immunological technique suited to detect antigens in a gel, revealed that the additional cell envelope proteins of all strains studied are immunologically related. The ACE protein is water-insoluble and hydrophobic in nature. Neither sulphur-containing amino acids nor sugar residues were detected. Its amino acid composition is remarkably similar to those of various proteins known to be present in additional surface layers and especially to the K88ad adhesive fimbriae of enteropathogenic *Escherichia coli*. As it has been reported that *A. salmonicida* strains possessing an additional layer show enhanced virulence as well as adhesion towards various eukaryotic cells, it is likely that these processes are mediated by the ACE protein and therefore that the ACE protein is a virulence factor. (Authors).

002308.

000034

Farkas, J., Olah, J.

1981. Occurrence of pasteurella and streptococcus in sheatfish *Silurus glanis* L. and common carp *Cyprinus carpio* L. Pages 124-133 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Fish. Res. Inst. 5541 Szarvas, P. O. Box 47, Hungary.).

The Pasteurella-like bacterium was isolated from 2 year old pen-reared sheatfish when the temperature was higher than 20°C. The bacterium caused septicemia and high mortality. The bacterium isolated from spleen and liver was similar to *Pasteurella piscicida*.

Streptococci belonging to serotype D were first isolated from carp gills attacked by gill necrosis. This bacterium was regarded the causative agent of the disease. We made artificial infections and the characteristic symptoms of the disease appeared occasionally after the pathogen was smeared on the gill. The bacterium could be isolated again from the parenchymal organs and gills. During the subsequent experiments, it became obvious that the gill changes examined, so-called gill necrosis, were caused by myxobacteria. The Streptococci are incidental bacteria present on gills damaged by myxobacteria. Investigating 500 healthy fish, bacteria were present at 0-20% depending on water temperature. For this reason, the Streptococcus isolated (like other fish pathogen bacteria) may be considered a member of normal gill microflora. The present paper describes the physiological-biochemical properties of these bacteria. (Authors).

002369.

000035

Farkas, J., Olah, J.

1981. Occurrence, experimental infection and treatment of myxobacterial gill disease of carp. Pages 483-492 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Fish. Res. Inst. P.O. Box 47 Szarvas, H-5541, Hungary.).

Both gills of 100 carp of different age groups were examined on 20 occasions in different pond systems. On the basis of these results, the frequency of myxobacterial gill disease was 0-50%, an average of 5-10%.

The appearance of myxobacteria was preceded by stress (i. e. high temperature and an increase in ammonia concentration of water, high pH value). Bacteria isolated were: Aeromonads, a Streptococcus of D serotype, and a myxobacterium. On the basis of experimental infections, the myxobacterium was responsible for the typical symptoms.

Physiological, biochemical characteristics and antibiotic resistance of eight myxobacterium strains are also dealt with.

Experimental infections were achieved as follows: a) smearing myxobacteria on gills; b) bathing in water containing myxobacteria; c) bathing carp with injured gills in water containing myxobacteria.

In case 'a' the symptoms always appeared on the gill but low temperature was a limiting factor. In cases 'b' and 'c' the infection was the function of temperature, duration of exposure and fish condition.

Myxobacterial gill disease could be prevented with chloramphenicol, oxytetracycline, and an antibiotic 'X' either by means of injection or by feeding. (Authors).

002400.

000036

Fijan, N.

1981. Vaccination of fish in European pond culture: prospects and constraints. Pages 70-81 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Dep. Biol. Pathol. Fish Bees, Vet. Fac, Univ. Zagreb, 41001 Zagreb, POB 190, Heinzelova 55, Zagreb, Yugoslavia.).

This paper reviews briefly the data on immunization of carp for the prevention of infectious dropsy and spring viremia. Discusses the advantages and disadvantages of the five known antigen delivery methods to fish. Indicates gaps in knowledge on these methods. Points out some aspects of future research on immunoprophylaxis of spring viremia of carp and carp erythrodermatitis, and finally assesses shortly the significance of the epizootiological situation in the pond culture for the possible benefits by immunization. In addition to the still inadequate information on etiology of several pondfish diseases and insufficient research data on immunization, one of the main constraints to a faster introduction of immunoprophylaxis into the praxis is the present impossibility to incorporate the most of the known vaccine administration methods into the production technology at a time when the water temperatures favor a good immune response of fish. (Author).

002366.

000037

Fijan, N., Matasin, Z., Jeney, Z., Olah, J., Zwillenberg, L. O.

1981. Isolation of *Rhabdovirus carpio* from sheatfish *Silurus glanis* fry. Pages 48-58 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Dep. Biol. Pathol. Fish Bees, Vet. Fac. 41001 Zagreb, P.O. Box 190, Yugoslavia.).

During rearing in recirculation system at 22°C, a great many sheatfish fry were affected by an over 90% mortality at the age between 8 and 18 days. Samples of sick and dead fry having a hydropic and hemorrhagic syndrome were examined virologically. A rhabdovirus that is serologically related to the causal agent of spring viremia of carp (SVC) was isolated on cell cultures. The role of the virus in mortality and the possible significance of the immunological immaturity of the fry for the outbreak of SVC or the SVC-like disease at 22°C are discussed. (Authors).

002364.

000038

Fitzgerald, M. E. C., Simco, B. A. , Coons, L. B.

1982. Ultrastructure of the peritrich ciliate *Ambiphrya ameiuri* and its attachment to the gills of the catfish *Ictaluras punctatus*. J. Protozool. 29(2);213-217. (Dep. Biol. Memphis State Univ. Memphis, Tenn. 38152.).

The ultrastructure, its attachment to gills, and its effect on the gill tissue were investigated by scanning and transmission electron microscopy. The peritrich attached to the gills by fibers extending from the scopula. A microtubular array, apparently a barren kinetosome, was present in each lobular projection, but no scopular ciliia were observed. At low densities *Ambiphrya* had no apparent harmful effects on the fish; however, at high densities respiration may be impeded. Ultrastructural studies indicate that this organism receives no nourishment from the host tissue. (Authors).

002293.

000039

Frechet, A., Dodson, J. J., Powles, H.

1983. The parasites of the American smelt (*Osmerus mordax*), anadromous to Quebec, and their use as biological tags. (Les parasites de l'eperlan d'amerique (*Osmerus mordax*) anadrome du Quebec et leur utilite comme etiquettes biologiques.) Can. J. Zool. 61(3):621-626. (Dep. Biol. Univ. Laval, Sainte-Foy (Que.), Canada G1K 7P4.).

Distribution of smelt parasites *Glugea hertwigi*, *Diphyllobothrium sebago*, and *Echinorhynchus salmonis* support previous hypotheses that three groups of anadromous smelt occur in Quebec waters. These groups are associated with three geographical areas: the Saguenay fjord, the south shore of the St. Lawrence estuary, and Chaleur Bay. Furthermore, the presence of two parasites almost exclusive to the smelt sampled in Forestville and Baie Comeau confirms the existence of a fourth group. (Authors). (Paper in French).

002335.

000040

Fryer, J. L., McCain, B. B., Leong, J. C.

1981. A cell line derived from rainbow trout (*Salmo gnirdneri*) hepatoma. Fish Pathol. 15(3,4):193-200. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331.).

A permanent cell line has been established from an aflatoxin-induced hepatoma of rainbow trout. The cell line is now 17 years old and has been carried through 133 serial passages. Chromosome analysis indicates the cells are heteroploid and show a bimodal distribution with modal numbers of 54 and 60. Cells are routinely cultured at 18°C and are easily stored in liquid nitrogen. They are susceptible to both the viruses of infectious hematopoietic necrosis and infectious pancreatic necrosis. It is not known if these cells have undergone malignant transformation. However, numerous attempts to cultivate normal liver cells have failed. This culture may represent the first salmonid cell line derived from tumorous tissue. (Authors).

002275.

000041

Fuhrmann, H., Bohm, K. H., Schlotfeldt, H. J.

1983. An outbreak of enteric redmouth disease in West Germany. J. Fish Dis. 6(3):309-311. (Inst. Mikrobiol. Tierseuchen, Tierarztliche Hochschule, Hannover, Fed. Rep. Germany.).

First report of enteric redmouth disease in central Europe. Identification of the organism was made by biochemical characteristics of the bacterium. (Ken Wolf).

002358.

000042

Goldstein, R. J.

1982. Your fishes health: velvet disease. Trop. Fish Hobbyist 30(10 #316):84-85. (T.F.H. Publications, Inc. 211 West Sylvania Ave. Neptune City, N.J. 07753.).

A well-written description of the tropical fish disease caused by dinoflagellates of the genus *Oodinium*. The organism and its life cycle are also described as are preventive hygienic and therapeutic control measures with malachite green solution and copper sulfate. The author suggests that because of their sensitivity to copper that snails be used as an indicator of appropriate chemical level for treatment of velvet disease. Neat! (Ken Wolf).

002288.

000043

Haldar, D. P., Mukherjee, M., Kundu, T. K.

1981. Observations on two new species of *Myxosoma* Thelohan, 1892 (Myxozoa: Myxosomatidae) from freshwater teleost fishes. Arch. Protistenk. 124(2):244-251. (Dep. Zool. Univ. Kalyani, Kalyani, West Bengal, India.).

The paper records the occurrence of *Myxosoma filamentosa* n. sp. and *Myxosoma dermitis* n. sp. from the common food fishes of India viz. *Punitius filamentosus* Cuvier and *Labeo rohita* Hamilton respectively. The spores of the parasites are described. The importance of the findings in the light of large scale destruction of edible fishes in India is also stressed. (Authors).

002338.

000044

Hazen, T. C., Esch, G. W.

1983. Effect of effluent from a nitrogen fertilizer factory and a pulp mill on the distribution and abundance of *Aeromonas hydrophila* in Albemarle Sound, North Carolina. App. Environ. Microbiol. 45(1):31-42. (Dep. Biol. Univ. Puerto Rico, Rio Piedras, Puerto Rico 00931.).

The density of *Aeromonas hydrophila*, standard count bacteria, fecal coliform bacteria, and 18 physical and chemical parameters were measured simultaneously at six sites for 12 months in Albemarle Sound, N.C. One site was above and two sites were below the discharge plume of a kraft pulping process paper mill. The fourth site was above and the remaining two sites were below the discharge point of a nitrogen fertilizer factory. The impact of the pulp mill on water quality was acute, whereas that of the nitrogen fertilizer factory was chronic and much more subtle. Diffusion chamber studies indicated that *A. hydrophila* survival is increased by pulp mill effluent and decreased by nitrogen fertilizer factory effluent. From correlation and regression analysis, *A. hydrophila* was found to be directly affected by phytoplankton density and, thus indirectly by concentrations of phosphate, nitrate, and total organic carbon. These two point sources are suspect as indirect causes of red-sore disease epizootics, a disease of fish caused by *A. hydrophila*. (Authors).

002318.

000045

Herms, J.

1983. Experience obtained in control of parasites in carp culture. (Erfahrungen mit der Bekampfung von Parasitosen bei der Karpfenproduktion.) Z. Binnenfisch. DDR 30(1):24-27. (Inst. Binnenfisch. DDR1162 Berlin-Friedrichshagen, Muggelsudamm 310, Dem. Rep. Germany.).

Trichorphon (Dylox) at a concentration of 0.2 mg/L was used to control dactylogyrosis. After treatment, carp were transferred to untreated ponds, because Dylox also kills food organisms–daphnia and copepods. Gyrodactylosis is also controlled by the same concentration of Dylox. The cost of treatment can be reduced by treating the feeding areas of ponds. In case this treatment is not successful, formalin can be used in quantities of 250 to 300 mL per cubic meter of water. Dylox is less effective at 15°C and lower temperatures. Malachite green (0.15 mg/L) is used to control ichthyophthiriasis and is most effective in low water temperature–not in spring and fall. Treated carp

should not be used for food for 4 weeks following treatment. The cestode *Bothriocephalus acheilognathi* was observed for the first time in Eastern Germany in 1976. Since then it has become an important parasite in carp farms. Control is difficult because copepods, important food organisms, are the intermediate hosts. Trichodina is a common parasite of carp and is controlled with formalin at the concentration of 100 to 150 mL per cubic meter of water that is circulated for 1 h. (S. F. Snieszko). (Paper in German).

002334.

000046

Hill, B.

1982. Disease – the constant challenge. Fish Farmer 5(5):8-9. (Minist. Agric. Fish. Food, Fish Dis. Lab. The Nothe, Weymouth, Dorset, England.).

Written for fish farmers in the United Kingdom, this popular article gives dates of first appearance in the U.K. of carp pox, UDN, furunculosis, and renibacterial kidney disease. The author then counsels hatchery operators on how and why infectious diseases occur and why the Diseases of Fish Act of 1937 is beneficial. In very general terms, promising research projects are discussed–projects with great potential for disease control. (Ken Wolf).

002280.

000047

Hoffman, G. L.

1981. Two fish pathogens, *Parvicapsula* sp. and *Mitrospora cyprini* (Myxosporea), new to North America. Pages 184-197 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polycultue, Szarvas, Hungary. 23-27 Jun. (U.S. Fish Wildl. Serv. Fish Farming Exp. Stn. P. O. Box 860, Stuttgart, Ark. 72160.).

Two fish diseases, new to North America, are reported. Proliferative chronic nephritis of pen-reared coho salmon, *Oncorhynchus kisutch*, caused by *Parvicapsula* sp. and kidney bloater disease of goldfish, *Carassius auratus*, caused by *Mitraspora cyprini*, are described. (Author).

002374.

000048

Huey, D. W., Beitinger, T. L.

1982. Methemoglobin levels in channel catfish, *Ictalurus punctatus*, exposed to nitrite and tricaine methanesulfonate. Can. J. Fish. Aquat. Sci. 39(4):643-645. (Dep. Biol. Sci. North Texas State Univ. Denton, Tex. 76203.).

Channel catfish (*Ictalurus punctatus*) were exposed for 24 h to one of the following: 4.0 mg/L nitrite, 4.0 mg/L nitrite 40 mg/L TMS-222, 40 mg/L TMS-222 and control in which neither chemical was added. Methemoglobin concentrations reported as percentage of total hemoglobin equalled mean ± SD (*n*) 65.9 ± 10.8 (10), 45.7 ± 9.1 (15), 13.7 ± 5.9 (26), and 2.2 ± 0.4 (10) in the four groups, respectively. Mean methemoglobin in each of the three treatment groups was significantly greater than controls and significantly different among each other. As expected, nitrite-induced methemoglobinemia was slightly reduced in the presence of TMS-222 for this short-term exposure. The most important finding was that catfish exposed to TMS-222 had methemoglobin levels six times greater than those of controls. (Authors).

002302.

000049

Itazawa, Y., Takeda, T.

1982. Respiration of carp under anesthesia induced by mixed bubbling of carbon dioxide and oxygen. Bull. Jpn. Soc. Sci. Fish. 48(4):489-493. (Dep. Fish. Fac. Agric. Kyushu Univ. 46-04 Hakozaki, Higashi, Fukuoka 812, Japan.).

Anesthetization of fish by mixed bubbling into the ambient water of carbon dioxide and oxygen is being tried as a method of live transport. To get fundamental information on fish under anesthesia, respiratory parameters were measured with carp before, during and after anesthesia induced by 1:1 mixed bubbling of carbon dioxide and oxygen. During the anesthesia, oxygen content and oxygen saturation of the arterial blood was maintained at levels higher than or equal to the pre-anesthetic ones owing to very high partial pressure of oxygen accompanied with elevated Ht and Hb in the blood, in spite of enormously high partial pressure of oxygen which ought to reduce the oxygen affinity of the blood. Gill ventilation was also maintained at the pre-anesthetic level due to increased frequency of respiration, notwithstanding its reduced stroke volume. Oxygen consumption was reduced to one-half its pre-anesthetic level, accompa-

nied with a sharp drop of oxygen utilization at the gills. (Authors).

002300.

000050

Iwata, K.

1982. The present situation of damage by the streptococcal disease of cultured yellowtail (*Seriola quinqueradiata*) and a control of the disease in Miyazaki Prefecture. Fish Pathol. 17(1):61-65. (Miyazaki Pref. Fish. Exp. Stn. Aoshima, Miyazaki, Japan.).

Mortality caused by the streptococcal disease of cultured yellowtail at fish farms in Kitaura Bay, Miyazaki Prefecture was investigated. Severe damage of streptococcal disease of cultured yellowtail occurred at central areas in fish farms. Change of severity of streptococcal disease has been closely related to fluctuations in the catch of sardines that are used as feed. It was concluded that occurrence of streptococcal disease resulted from fish culturing techniques. (Author). (Paper in Japanese).

002279.

000051

Jeney, G., Molnar, K.

1981. Thelohamellosis of the common carp fry in Hungary. Pages 205-209 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Sci. Res. Inst. Fish. Szarvas P/Y 47, 5541 Hungary.).

This disease has become widespread in the south-east region of Hungary.

The first sign of the infection of 4-6 week old fingerlings is a black coloration on the fins in a transversal stripe, caused by developing cysts around the fin rays. In 2 weeks millet sized cysts appear in fins filled up by young spores and developmental stages. Cysts burst and release spores in September, but marks of the survived infection are detectable even on overwintered fish. The cyst is composed of a thin cyst wall of parasite origin and a very thick host capsule. The host capsule is built up by a loose connective tissue, consisting of cartilaginous islets and covered by multilayered epithelium. No casualities were observed among fingerlings. The parasite is identified as *Thelohanellus dogieli*, which might be identical with *T. nikolskii*. The parasite could have entered Hungary with wild amur carp. (Authors). (Paper in Russian).

002376.

000052

Jeney, G., Nemcsok, J., Olah, J.

1981. Transaminase enzyme activity of cyprinid fishes depending on environmental factors and bacterial infection. Pages 322-331 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Fish. Res. Inst. Szarvas, P.O. Box 47, Hungary.).

Transaminase activity was used to detect damage to tissue caused by adverse environmental factors and bacterial infection. Serum GOT and GPT activity in three fish species (*Hypophthalmichthys molitrix, Ctenopharyngodod idella, Cyprinus carpio*) depending on their ages was determined. In all species the highest activity was measured in 3-year-old specimens. There were no significant differences between species of the same age, regarding serum transaminase activity. Serum transaminase activity of carp was measured as a function of temperature, season, different NH_3 concentration and bacterial infection. GOT and GPT activities changed in parallel with increased temperature. The highest activity was measured during the summer period and the lowest in winter. This might correlate with metabolic rate or it might represent increased excretion and detoxification of ammonia. Serum transaminase activity enhanced together with increased ammonia concentration and with the duration of the treatment reflecting the role of GOT, GPT in detoxification of ammonia and could represent the necrosis of gills followed by the ammonia treatment or the bacterial infection. Serum transaminase activity proved suitable to detect tissue damage caused by adverse environmental factors, and bacterial infection. (Authors).

002386.

000053

Jensen, N. J., Larsen, J. L.

1982. The ulcus-syndrome in cod (*Gadus morhua*) IV. Transmission experiments with two viruses isolated from cod and *Vibrio anguillarum*. Nord. Veterinaermed. 34:136-142. (Aquat. Pathobiol. Ambulatory Clinic and Cen-

tral Clinical Lab. Royal Vet. Agric. Univ. Copenhagen, Denmark.).

The pathogenesis of the ulcus-syndrome in cod is complex. It is indicated that an icosahedral cytoplasmatic virus may produce the initial stage of the ulcus-syndrome while *Vibrio anguillarum* seems to support the further development of the disease. (Authors).

002307.

000054

Jinde-Lowe, L., Niimi, A. J.

1983. Influence of sampling on the interpretation of hematological measurements of rainbow trout, *Salmo gairdneri*. Can. J. Zool. 61(2):396-402. (Dep. Zool. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

Hematological parameters of rainbow trout (*Salmo gairdneri*) were examined to determine if the sampling influenced the measurements. The results indicated that hematocrit values of fish anesthetized with tricaine methanesulfonate (TMS or MS 222) samples after 5-20 min were significantly higher than of fish sampled within 1 min of capture and anesthesia. No differences were observed among hemoglobin content, erythrocyte, and leucocyte counts or their differential cell ratios over the 20-min period. Hemoglobin content and erythrocyte counts increased significantly with size among the three groups examined. It is suggested that differential blood cell ratios could be used as a reliable hematological index because the ratios appear to be independent of the effects of sampling over a short time period. (Authors).

002322.

000055

Jorgensen, P. E. V.

1973. The nature and biological activity of IPN virus neutralizing antibodies in normal and immunized rainbow trout (*Salmo gairdneri*). Arch. gesamte Virusforsch. 42:9-20. (State Vet. Serum Lab. Dep. Jutland, Hangovej 2, DK-8200 Arhus, Denmark.).

By means of the plaque-reduction technique high titers of neutralizing antibodies to IPN virus were demonstrated in serum from rainbow trout reared in apparently IPN-free environments as well as from trout exposed to the virus through natural or artificial infection. The neutralizing antibodies were in all cases found to be sensitive to incomplete reduction and alkylation. When trout sera were subjected to gel filtration on Sepharose 4B high titers of neutralizing antibodies were found in fractions from the first protein peak, which contained a protein of. beta 2 (macroglobulin) mobility.

The production of a monovalent rabbit antiserum to trout immunoglobulin is described. (Author).

002284.

000056

Kelly, R. K., Nielsen, O., Mitchell, S. C., Yamamoto, T.

1983. Characterization of *Herpesvirus vitreum* isolated from hyperplastic epidermal tissue of walleye, *Stizostedion vitreum* (Mitchill). J. Fish Dis. 6(3):249-260. (Dep. Fish. Oceans, Freshw. Inst. 501 Univ. Crescent, Winnipeg, Man. Canada R3T 2N6. Canada.).

The virus, which was isolated in the walleye ovarian (WO) cell line, was identified as a herpesvirus on the basis of size, morphology, and apparent pattern of replication. The virus was etherlabile and replicated in WC-1 cells at 4 and 15°C, but not at 20°C. Although walleye cell lines (WO, WC-1, We-2) were susceptible to infection at 15°C, non-percid cell lines were refractory. Syncytial formation and lysis occurred in susceptible cell lines. Virus was quantified by plaque assay at 13 to 15°C for 2 weeks. Replication was inhibited by 10^{-3} • M phosphonoacetate and by 10^{-3} • M 5-bromodeoxyuridine (BUDR), but addition of excess thymidine reversed the inhibition by BUDR. Viral replication in WO cells, but not in WC-1 cells, was inhibited by the antiherpetic drug acyclovir (10^{-3} • M). The relationship of the herpesvirus isolate and epithelial neoplasms was not determined. (Authors).

002353.

000057

Khalifa, K. S., Al-Khayat, K. M., Al-Rijab, F. H.

1983. Ichthyophthiriasis in farmed fishes in Iraq. J. Wildl. Dis. 19(2):145. (Dep. Microbiol. Coll. Vet. Med. Univ. of Baghdad, Baghdad Iraq.).

A case report. The epizootic occurred over a period of 3 months and mortality exceeded 40%. (Ken Wolf).

002350.

000058

Kiceniuk, J. W., Khan, R. A., Dawe, M., Williams, U.

1982. Examination of interaction of trypanosome infection and crude oil exposure on hematology of the longhorn sculpin (*Myxocephalus octodecemspinosus*). Bull. Environ. Contam. Toxicol. 28(4):435-438. (Dep. Fish. Oceans, Northwest Atlantic Fish. Cent. P. O. Box 5667, St. John's, Newfoundland, Canada A1C 5X1.).

A high proportion of fish species off the coast of Labrador harbor trypanosome infections. The latter are known to induce hematological changes in marine fish. Exposure to oil is also known to produce blood changes. We therefore hypothesized that trypanosome infection and exposure to oil might interact to alter the hematology of fish. (Authors).

002268.

000059

Kimura, T., Yoshimizu, M.

1983. Coagglutination test with antibody-sensitized staphylococci for rapid and simple serological diagnosis of fish furunculosis. Fish Pathol. 17(4):259-262. (Lab. Microbiol. Fac. Fish. Hokkaido Univ. Hakodate, Hokkaido, Japan.).

This test proved to be a simple, rapid and reliable diagnostic procedure for furunculosis in the field as well as in the laboratory without any special apparatus. Furuncle or kidney sample from diseased fish is homogenized with nine volumes of PBS, and heated in boiling water for 30 min. The supernatant is collected after centrifugation at 4000 rpm for 20 min. This may be omitted if a centrifuge is unavailable. One drop of the supernatant and one drop of anti-*A. salmonicida* antibody-sensitized staphylococci suspension are mixed on a glass slide and incubated at room temperature. The results are read after 30 and 60 min. If positive results were observed by means of the coagglutination test, the existence of *A. salmonicida* in the same samples which were employed on the coagglutination test should be reconfirmed by using a conventional cultural procedure. (Authors). (Paper in Japanese).

002297.

000060

Kimura, T., Yoshimizu, M., Tanaka, M.

1983. Susceptibility of different fry stages of representative salmonid species to *Oncorhynchus masou* virus (OMV). Fish Pathol. 17(4):251-258. (Lab. Microbiol. Fac. Fish. Hokkaido Univ. Hokkaido, Japan.).

Susceptibility in fry of several salmonid to *Oncorhynchus masou* virus (OMV) was studied. Each 100 fry of chum salmon (*Oncorhynchus keta*; 0, 1, 2, 3, 4, 5, 6 and 7-month-old), masu salmon (*O. masou*; 0, 3 and 5-month-old), kokanee salmon (*O. nerka*; 0 and 1-month-old), coho salmon (*O. kisutch*; 0 and 1-month-old) and rainbow trout (*Salmo gairdneri*; 1.6-month-old) were used. The fry were immersed for 1 hour in 10°C water containing 100 $TCID_{50}$/ml of culture grown OMV, and then held in running water at 10-15°C.

The cumulative mortality of just hatching chum salmon, observed in ensuing 4 months was 35%, but between 1-month-old and 5-month-old fry, the cumulative mortality was more than 80%, in particular, at 3-month-old, the fry exhibited 98% mortality, the greatest sensitivity. At 6- and 7-month-old, the frys' susceptibility was reduced and only 7% and 2% fish had succumbed. On the other hand, masu salmon fry, at 1-month-old, was the most sensitive and the cumulative mortality reached 87%. In 3-month to 5-month-old fry, cumulative mortality decreased from 65% to 24%. Comparing the five different salmonid fry, at the age of 1-month-old, for relative sensitivity to OMV, kokanee salmon exhibited the greatest sensitivity, and 100% of them died. Masu salmon and chum salmon exhibited high sensitivity at 87% and 83% mortality respectively. Coho salmon and rainbow trout were shown less sensitive to OMV infection at 39% and 29% mortality respectively. (Authors). (Paper in Japanese).

002283.

000061

Kourany, M.

1983. Medium for isolation and differentiation of *Vibrio parahemolyticus* and *Vibrio alginolyticus*. Appl. Environ. Microbiol. 45(1):310-312.

(Gorgas Mem. Lab. Apartado 6991, Panama 5, Panama.).

Trypticase soy agar supplemented with sucrose, sodium chloride, bile salts, and triphenytrazolium chloride is an improved plating medium for the isolation of *Vibrio parahemolyticus* from samples of seawater, permitting better differentiation of this organism from *Vibrio alginolyticus* and other bacteria. (Author).

002316.

000062

Kovacs-Gayer, E.

1981. Histopathological differential diagnosis of gill changes with special aspect of gill necrosis. Pages 493-505 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Cent. Vet. Inst. 1581 Budapest, Tabornok u. 2. Hungary.).

The results of histological examinations in the years of 1979 and 1980 on gill necrosis are summarized in this work. In the pathogenesis of gill necrosis acute and chronic inflammatory stages were established that may develop into diffuse necrosis. By histological examination data were gained for differential diagnosis of gill necrosis of carp. It was stated that histopathology has importance in diagnosis of the disease, especially at early stage. But the fact must be also considered that anoxia, ammonia toxicosis, and effect of pesticides, heavy metalions can also be the cause of acute inflammation in the gill.

Pathology of the disease is often aggravated by parasites and bacteria as *Flexibacter* spp. (Author).

002401.

000063

Kovacs-Gayer, E., Pusztay, M.

1981. A new method to study ammonia content of fish blood. Pages 371-379 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Cent. Vet. Inst. Budapest, Hungary.).

A quick and simple method was elaborated to measure pH and ammonia level of fish blood with a water testing instrument OP-NH_3-264 RADELKIS, Hungary. On the basis of evaluation of 370 blood samples, the normal values of ammonia in carp–during the vegetation period–were never higher than 150 mg/L. Close correlation was found between the ammonia level of fish blood and the ammonia level of water taken from the same place as the fish. Because of this fact months of May and June are thought to be critical concerning the state of gill which is the main organ of ammonia secretion. (Authors).

002390.

000064

Kreutzmann, H. L., Haney, E., Lautenschlag, K., Osterland, P.

1983. The effect of environmental changes as termperature, salinity, feeding and the presence of ionized lead on the selected hematologic parameters in rainbow trout (*Salmo gairdneri* Rich.). (Haupt- und Wechselwirkungen der Umwelteinflusse Temperatur, Salinitat, Futterregime und Bleiionen auf das Blutbild der Regenbogenforellen (*Salmo gairdneri* Rich.).) Z. Binnenfisch. DDR 30(1):29-30. (Wilhelm-Pieck Univ. Rostock, Sektion Biol. 25 Rostock, Universitaetsplatz 2, Dem. Rep. Germany.).

Trout were maintained at 6 or 18°C. Some were fed regularly and others were starved during the test. Some trout in each group were exposed to ionized lead. The most pronounced changes were caused by temperature. Trout at 18°C had somewhat lower levels of hemoglobin and hematocrit. (S. F. Snieszko). (Paper in German).

002329.

000065

Kuhns, J. F.

1981. Fishdrug/txt: a computer generated bibliographic index of the drugs and chemicals used in treating fish diseases - part IV. J. Aquaricult. 2(4):90-102. (Aquascience Res. Group, 1100 Gentry, North Kansas City, Mo. 64116.).

This paper, the fourth of four parts, is an index by substance of unannotated bibliographic citations of the literature dealing with the drugs and chemicals used in the treatment of organic and environmental diseases of fish. The substances are arranged alphabetically. Each entry is followed by a specific citation to the literature in which the substance (entry) is discussed. This fourth part includes the portion of the alphabetical section (sub-

stances in which an upper-case Roman letter is the first character in the name) Q through Z and the third section which consists of entries in which lower-case Roman and upper-and lower-case Greek letters are the first characters. This part has a total of 384 entries. (Author).

002289.

000066

Kulow, H.

1982. Recommendations for reduction of the use of toxic substance in pond fish culture. (Empfehlungen zur anwendungsbegrenzung von Schadstoffen in Binnengewassern.) Z. Binnenfisch. DDR 29(9):263-266. (Inst. Binnenfischerei Berlin-Friedrichshagen, Fed. Rep. Germany.).

This report consists mainly of tables showing losses in fishes caused by noninfectious and infectious agents in the culture of carp and trout. Tables also show toxic concentrations of pesticides and industrial pollutions. The following information is extracted from these tables. In carp production the average losses, based on data from six establishments, were 43% in fish 1-2 years old and 15% in those 2 years old and older. Out of these losses, 58% were caused by environmental factors and 18% by infectious diseases. The presence of ammonia was the most important lethal environmental factor. In trout culture, losses caused by environmental factors amounted to 55% and by infections 22%. Ammonia was the most important cause of mortality in trout culture. (S. F. Snieszko). (Paper in German).

002311.

000067

Kulow, H.

1981. Epizootiological situation of fish in GDR and the tasks of fish pathological research. Pages 518-527 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Inst. Inland Fish. 1162 Berlin, Muggelsedamm, German Dem. Rep.).

Two crucial factors determine the epizootiological situation of fish farming in GDR. The diseases and losses registered are caused by some 188 fish diseases. Twenty to forty percent of the total loss is caused by pathogens, while in 50-60% no pathogens can be detected. Considering the losses and diseases, 10 complex demands are set up to the ichthyopathological research. (Author). (Paper in Russian).

002404.

000068

Kusuda, R., Kawai, K., Shirakawa, T.

1982. Serological study of *Streptococcus* sp. pathogenic to cultured yellowtail. Bull. Jpn. Sci. Fish. 48(12):1731-1738. (Fish. Dis. Lab. Fac. Agric. Kochi Univ. Nankoku, Kochi 783, Japan.).

The causative organism of infection in *Seriola quinqueradiata* had characteristics intermediate between *S. faecalis* and *S. faecium*. In this paper, some serological characteristics were examined in order to make the taxonomical position clear. Grouping of the strains was performed by capillary tube test and Ouchterlony's test. Typing was performed by agglutination reaction and immunoelectrophoresis. All 86 strains isolated from yellowtail and some strains isolated from amberjack, dragonet and eel had common group specific antigen extracted by Lancefield's method. But this antigen was different from the antigens of group A to H, K, L, N, O and MG. Further it was revealed that the new group specific antigen did not exist in the cell wall as in the case of the group D streptococci. Some other antigens were detected in the cell wall by immunoelectrophoresis and on the cell surface by agglutination reaction. These antigens were detected in all the pathogenic strains. It is concluded that the pathogenic strains consist of a new group of *Streptococcus* not reported before. (Authors). (Paper in Japanese).

002331.

000069

Larsen, J. L.

1982. *Vibrio anguillarum*: prevalence in three carbohydrate loaded marine recipients and a control. Zentralbl. Bakteriol. Hyg. I Abt. Orig. C 3:519-530. (Inst. Hyg. Microbiol. Royal Vet. Agric. Univ. Bulowsvej 13, DK-1870 Copenhagen V. Denmark.).

Study of *Vibrio anguillarum* like organisms (VLO) in three marine recipients, polluted with effluents from sugar and cellulose factories, showed some characteristic features.

In winter very low counts of VLO were recorded. During temperature rise in spring the VLO values rise from June to September. A decline occurs at this time, except in sites polluted from sugar plants, where there is a delay of one month.

In the relatively stable period the prevalence of VLO in the recipients is approximately 10-100 per ml and 1,000-10,000 per gram sediment while values for the control are 1-10 per ml and 100-1,000 per gram. Thus fish living in these recipients are exposed to a ten times higher risk from VLO. The complicated nature of pollution induced diseases makes it impossible directly to correlate VLO and disease. This group of bacteria should be added to the list of marine indicator organisms. (Authors).

002276.

000070

Larsen, J. L., Jensen, N. J.

1982. The ulcus-syndrome in cod (*Gadus morhua*) V. Prevalence in selected Danish marine recipients and a control site in the period 1976-1979. Nord. Veterinaermed. 34:303-312. (Microbiol. Royal Vet. Agric. Univ. Copenhagen, Denmark.).

The ulcus-syndrome in cod occurs with high prevalence in marine recipients receiving effluents from sugar and cellulose factories especially in autumn and may be considered as a biological effects monitor. (Authors).

002306.

000071

Lemly, A. D.

1980. Effects of a larval parasite on the growth and survival of young bluegill. Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies 34:263-274. (Dep. Biol. Wake Forest Univ. Winston-Salem, N.C. 27109.).

Seasonal dynamics of metacercariae of *Uvalifer ambloplitis* (Hughes 1927), the black spot parasite of centrarchids, were monitored over a 12 month period for bluegill (*Lepomis macrochirus*) @70 mm total length. Prevalence of infection ranged from 8% in April to 97% in September. Mean parasite density during September was 16 metacercariae per host although individual infections of over 100 per host were not uncommon. Data indicate that heavily infected hosts (50 metacercariae per fish) were most abundant during September, and were eliminated from the population by January. This removal appears to be selective and may involve effects of the parasite on host swimming and/or feeding ability. Infections of *U. ambloplitis* metacercariae may be a factor influencing year class strength and subsequent growth of bluegill in waters where densities exceed 50 per host for individuals less than 50 mm total length. (Authors).

002294.

000072

Liewes, E. W., Van Dam, R. H., Vos-Maas, M. G., Bootsma, R.

1982. Optimization and kinetics of in vitro stimulation of carp (*Cyprinus carpio* L.) leukocytes. Vet. Immunol. Immunopathol. 3:325-343. (Dep. Special Anim. Pathol. Univ. Utrecht, Utrecht, The Netherlands.).

The optimization of a leukocyte stimulation microassay with carp (*Cyprinus carpio* L.) leukocytes is described. Leukocytes were isolated from the thymus, anterior kidney, spleen, mid-kidney, and peripheral blood. Leukocyte cultures were stimulated with PHA-P, LPS (*Escherichia coli* 055: B5) PWM, ConA, and PPD from *Mycobacterium fortuitum*. The optimum incubation temperature for leukocyte cultures differed depending on the mitogen used. The optimum incubation period was 3.5 days for leukocyte cultures derived from lymphoid organs and 4.5 days for peripheral blood lymphocyte cultures. Leukocytes from various organ sources showed similar reactivity patterns to stimulation in vitro by different mitogens. The results of these mitogen stimulations did not present sufficient arguments in favor of compartmentation. (Authors).

002286.

000073

Lom, J., Dykova, I.

1981. Pathogenicity of some protozoan parasites of cyprinid fishes. Pages 146-169 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Inst. Parasitol. Czechoslovak Acad. Sci. Prague, Czechoslovakia.).

Pathogenic protozoa of carp fingerlings are reviewed. *Sphaerospora* sp. develops in the stratified epithelium of gill filaments and in epithelial cells covering secondary lamellae causing serious, respi-

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ration impairing lesions. *Chloromyxum cyprini*, known to inhabit gall bladder, may invade the liver tissue in carp and grasscarp causing massive necrosis. Four myxozoan species were found to infect carp kidneys. Two of them were recorded in Czechoslovakia for the first time, i.e. *Sphaerospora* sp. and *Mitraspora cyprini*. Both species live in the lumen of the renal tubuli, but have early intracellular stages within the tubular epithelium and provoke distint histopathological changes. Structures tentatively classified as developmental stages of *Hoferellus cyprini* were found in 17% of the surveyed ponds. Large accumulations of the parasites rupture the tubule's basement membrane and are released into the interstitium. *Myxobolus cyprini* Doflein, 1898 was found on 34% of surveyed localities. No pathogenicity was recorded. (Authors).

002370.

000074

Lucky, Z.

1981. An investigation of invasive diseases of the fry of herbivorous fishes and their treatment. Pages 259-269 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture. Szarvas, Hungary. 23-27 Jun. (Dep. Poultry, Fish, Bee, Wildl. Dis. Vet. Sch. Brno, Czechoslovakia.).

This study evaluated results of parasitological investigation of fry of *Hypophthalmichthys molitrix*, *Aristichthys nobilis* and *Ctenopharingodon idella*.

In *H. molitrix* 15 pathogens were found, among them *Myxobolus pavlovskii*, which was introduced with imported fish, the other parasites transferred from inland fish.

In *A. nobilis* six parasites were registered, *M. pavlovskii* and *Dactylogyrus nobilis* transferred from imported fish, the other species belong to local parasitofauna.

In *C. idella* eight pathogens were diagnosed, but only the species *Dactylogyrus lamellatus* belongs to specific parasites of this fish species, the other ones are common parasites of fish.

The present report evaluates the pathogens seasonal dynamics and pathogenicity.

Among the experimented antiparasitic baths, the long-term bath of copper sulphate at a dose of 1.5-2 mg/L water for 48 h proved best. NaCl at 50 g/L for 3 min was effective for dactylogyrosis. The report also evaluates technical and hygienic procedures for disease prevention. (Author).

002381.

000075

Majeed, S. K., Gopinath, C.

1983. Cutaneous tuberculosis in the carp, *Cyprinus carpio* L. J. Fish Dis. 6(3):313-316. (Dep. Pathol. Huntingdon Res. Cent. Huntingdon PE18 6ES, England.).

Case report of a predominantly cutaneous form of mycobacteriosis among 25 of 170 specimens. Mycobacteria, as determined soley by acid-fast stained bacteria, were also found in muscle, gill bases, liver, spleen and kidneys. No evidence of tubercles was found. (Ken Wolf).

002359.

000076

Malik, E., Olah, J.

1981. Influence of water quality and feeding on ammonia nitrogen of carp blood. Pages 354-370 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Sci. Res. Inst. Fish Cult. 5541 Szarvas, P/Y 47, Hungary.).

Schreckenbach et al. (1978) found a close correlation between the NH_4 content of carp blood and the so-called gill necrosis. This disease, regarded as NH_3-intoxification, was always accompanied by NH_4-N content of blood above 3.50 mg. dm^{-3}.

Blood samples were taken from pen-reared carp every 3-4 h from 4-10 specimens and NH_4-N content was determined. Maximum value of NH_4-N content of blood was measured 3-6 h after feeding with protein rich feed in cases when excretion was inhibited some way. High ammonium content of the pond and reduced gill surface were regarded as inhibiting factors.

We found that NH_4-N content of carp blood bred in ponds with liquid manure, linearly changed with the manure load.

The NH_4-N content of blood alters periodically in a day together with certain parameters of the pond from which it showed regression with temperature and O_2 content.

When measuring the NH_4-N content of blood withdrawn monthly from carp we established that pH value higher than nine terminated the flexible change of NH_4-N content of blood. 3 mg. dm^{-3} NH_4-N content was measured one month after significant increase of pH of the pond. (Authors). (Paper in Russian).

002389.

000077

Matskasi, I.

1981. The effect of *Bothriocephalus acheilognathi* infection on the protease and αamylase activity in the gut of carp fry. Pages 403-411 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Vet. Res. Inst. Hungarian Acad. Sci. H-1143 Budapest, Hungary 21.).

Common carp fry infected by the tapeworm, *Bothriocephalus acheilognathi* Yamaguti, 1934, showed significantly lower intestinal trypsin and chymotrypsin activities than noninfected fry reared in the same pond farm. Extracts prepared from larval and adult stages of the tapeworm depressed the trypsin and chymotrypsin activities of fish gut washing fluids in vitro. The infection was effectless on the α-amylase activity of fish gut. (Author).

002393.

000078

McCarthy, D. H.

1983. An experimental model for fish furunculosis caused by *Aeromonas salmonicida*. J. Fish Dis. 6(3):231-237. (Tavolek Inc, Redmond, Wash. 98052.).

Development of an experimental bath challenge method for fish furunculosis caused by *Aeromonas salmonicida* is described. The influence of certain important experimental variables was investigated and standardized. Possible application of the model is discussed. (Author).

002352.

000079

McCarthy, D. H., Roberts, R. J.

1980. Furunculosis of fish – the present state of our knowledge. Pages 293-342 *in* M. R. Droop and H. W. Jannasch, eds. Advances in aquatic microbiology, Vol. 2. Academic Press, New York. (MAFF Fish Dis. Lab. Weymouth, Dorset, England.).

An aptly titled review, which in the authors' words is an effort to provide a unified base for future research. Topics include an introduction, history, clinical and gross pathologic features, histopathologic findings, disease in nonsalmonids, carp erythrodermatitis, immunology, hematology, virulence mechanisms, serology, ecology, classification, therapy, and control. The 49 pages include 121 references. (Ken Wolf).

002303.

000080

Meyers, T. R.

1983. Serological and histopathological responses of rainbow trout, *Salmo gairdneri* Richardson, to experimental infection with the 13_{p2} reovirus. J. Fish Dis. 6(3):277-292. (Dep. Avian Aquat. Anim. Med. New York State Coll. Vet. Med. Cornell Univ. Ithaca, N. Y. 14850.).

Both fingerling and adult rainbow trout were given intraperitoneal inoculations of the 13_{p2} reovirus which did not result in mortalities but produced a subclinical disease in 56% of the adults and in 65% of the juvenile fish. Sera from virus infected adult trout contained virus neutralizing and precipitating antibodies and demonstrated immunofluorescence of antigen(s) specific for the 13_{p2} virus. Virus infection was characterized by increased virus titers and a multifocal reticuloendothelial granulomatous hepatitis, occasionally accompanied by a fibrosing pancreatitis. Electron microscopy of infected liver tissues demonstrated arrays of 13_{p2} virus particles in a reticuloendothelial cell phagosome and in a hepatocyte lipid inclusion body from one of three juvenile fish examined. These results show that 13_{p2} virus inoculation of rainbow trout causes a non-virulent virus infection accompanied by specific humoral antibodies. (Author).

002356.

000081

Michel, C., Bassalert, J. F.

1982. Effect of temperature on the antibiotic sensitivity test performed by the disk method in fish pathology. (Influence de la temperature sur les resultats de l'antibiogramme pratique par la methode de diffusion en ichtyopathologie.) Ann. Rech. Vet. 13(3):245-250. (Lab. Ichtyopathol. INRA, 78850 Thiverval-Grignon, France.).

The sensitivity disk method is generally performed at temperatures lower than 37°C, at which standard procedures were recommended by WHO. In order to check up the reliability of the results, selected strains and antibiotic substances were studied at 37°C and 22°C. Readings of the zones of inhibition were done, after 24 and 48 h of incubation. Minimal inhibitory concentrations (MIC) had been determined using an agar-plate dilution method. Each association drug-bacterial strain provided three samplings of 30 measures which were compared by variance analysis and mean comparison tests. Variances did not differ, except with chloramphenicol and tetracyclines. But the mean values of the diameters significantly differed according to the incubation temperature. The variations could reach 7 to 8 mm, in any way. So, it appears that the disk method fails to allow any quantitative interpretation when performed at 22°C. Consequences in diagnostic of fish diseases are stressed. (Authors). (Paper in French).

002277.

000082

Miller, N. W., Tripp, M. R.

1982. The effect of captivity on the immune response of the killifish, *Fundulus heteroclitus* L. J. Fish Biol. 20(3):301-308. (Sch. Life Health Sci. Univ. Delaware, Newark, Del. 19711.).

Fundulus heteroclitus maintained under (sic) laboratory for more than 4 weeks showed a significantly lower immunocytoadherence (rosette) response to thymus-dependent antigens (SRBC and DNP-BSA) than newly captured fish. There was no comparable effect on scale allograft rejection nor in the response to a thymus-independent antigen (DNP-Ficoll) as measured by the rosette response. This suggests that captivity has a differential effect on a subpopulation of lymphocytes analogous to the T-helper cells of mammals. (Authors).

002269.

000083

Minagawa, T., Nakai, T., Muroga, K.

1983. *Edwardsiella tarda* in eel culture environment. Fish. Pathol. 17(4):243-250. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama, 720 Japan.).

Field surveys on the presence and abundance of *E. tarda* in water and mud of eel culture ponds in Tokushima Prefecture were made at four seasons from 1981 to 1982 by a modification of the detection method described by Wyatt et al. (1979). The incidence of *E. tarda* in water (W) and mud (M) samples from some 30 ponds were 90% (W) and 91% (M) in summer, 97% (W) and 100% (M) in autumn, 48% (W) and 25% (M) in winter, and 73% (W) and 75% (M) in spring. The number of organisms also increased during the warmer season. From the results of intramuscular injections into Japanese eels (*Anguilla japonica*), 37 strains out of 159 strains of *E. tarda* isolated from water and mud samples were proved virulent. Although these virulent strains shared common O-antigens with each other, they were divided into two serotypes based on absorption tests. About one-third of the avirulent strains also agglutinated with rabbit O-antisera against the virulent strains. (Authors). (Paper in Japanese).

002344.

000084

Mitchell, S. J., Cech, J. J. Jr.

1983. Ammonia-caused gill damage in channel catfish (*Ictalurus punctatus*): confounding effects of residual chlorine. Can. J. Fish. Aquat. Sci. 40(2):242-247. (Wildl. Fish. Biol. Univ. California, Davis, Calif. 95616.).

Histological evidence failed to confirm that ammonia is a direct causative agent of gill hyperplasia, as previously believed, in channel catfish, *Ictalurus punctatus*. Levels of residual chlorine compounds, which are typical of charcoal-filtered municipal water or chlorinated sewage effluent, together with moderate ammonia levels caused severe gill hyperplasia. These results question both the validity of attributing gill tissue hyperplasia to ammonia alone by past investigations and emphasize the serious problem of obtaining contaminant-free water for aquatic toxicological studies. (Authors).

002340.

000085

Moller, H.

1983. High skeletal deformation rates of cod in the Elbe estuary. Bull. Eur. Assoc. Fish Pathol. 3:7-8. (Inst. Meereskunde Univ. Dusternbrookerweg 20, D-2300 Kiel, Fed. Rep. Gemany.).

Cod and herring with skeletal deformities have been studied in the Elbe estuary, central German Bight and the Kattegat. Large proportions of deformed fish were caught during the summer months. It is considered this fluctuation in the proportion of diseased fish is due to migration of healthy fish. However, the figures indicate a greater incidence of deformed fish in coastal waters as compared with offshore areas of the North Sea. Further studies are required to elucidate the cause. (Author).

002347.

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Molnar, K.

1981. Some peculiarities of oocyst rejection of fish coccidia. Pages 170-183 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Vet. Med. Res. Inst. Hungarian Acad. Sci. 1581 Budapest, P.O. Box 18, Hungary.).

Most coccidia leave the fish in sporulated stage. Besides the few exceptions which are shed non-sporulated, there are also species which exhibit the possibility of rejecting variable oocysts in non-sporulated and sporulated stage as well. The fact whether sporulated or non-sporulated oocysts are shed, is mostly regulated by the species itself, but also affected by the location in the fish and by the host reaction. Species developing close to the intestinal lumen can easily leave the fish non-sporulated, but others inhabiting deeper layers or inner organs always finish sporulation inside the host. In case of *Eimeria* species developing in epithelial cells of the intestine, as a result of regeneratin, the oocyst containing invaded cells overgrown by the uninfected ones are pushed into the deep layers. In this case the rejection of oocysts is accomplished only secondarily. In inner organs where the rejection is impossible, the oocysts leave the fish only after the death of the host, unless they are destroyed by RES macrophages. (Author).

002373.

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Morikawa, S., Tashiro, F.

1982. Median lethal dose of *Aeromonas salmonicida* on Amago salmon (*Oncorhynchus rhodurus*). Fish. Pathol. 16(4):181-185. (Gifu Pref. Fish. Exp. Stn. Hagiwara-cho, Gifu, Japan.).

Median lethal doses (LD_{50}) of *Aeromonas salmonicida* on Amago salmon, *Oncorhynchus rhodurus* were studied by three different infection routes. LD_{50} of the bacteria on Amago salmon by intramuscular injection, intraperitoneal injection and bathing method were estimated as 4.3-5.1 X 10^6 CFU/fish, 3.0-4.5 X 10^3 CFU/fish and 2.2-2.7 X 10^6 CFU/ml, respectively. The fluctuations of LD_{50} obtained in the duplicate experiments were ignorable. This suggests the advantage of using genetic isolated stocks of fish for the experimental animal. (Authors). (Paper in Japanese).

002299.

000088

Morrison, C., Shum, G.

1983. Epitheliocystis in American plaice, *Hippoglossoides platessoides* (Fabricius). J. Fish Dis. 6(3):303-308. (Dep. Fish. Oceans, Fish. Environ. Sci. Halifax Lab. P. O. Box 550, Halifax, Nova Scotia, Canada B3J 2S7.).

Case report describing and illustrating hypertrophied host cells and the presumed causal agent. Light and electronmicrographs provide convincing evidence in support of the title. (Ken Wolf).

002357.

000089

Mulcahy, D., Burke, J., Pascho, R., Jenes, C. K.

1982. Pathogenesis of infectious hematopoietic necrosis virus in adult sockeye salmon (*Oncorhynchus nerka*). Can. J. Fish. Aquat. Sci. 39(8):1144-1149. (U.S. Fish Wildl. Serv. Natl. Fish. Res. Cent. Bldg. 204, Naval Support Activity, Seattle, Wash. 98115.).

The concentration of infectious hematopoietic necrosis (IHN) virus was determined in eight organs and two body fluids from each of 60 adult sockeye salmon (*Oncorhynchus nerka*). Included in the sample were four males and 56 prespawning, spawning, or spent female fish. All fish were in-

fected, and virus was present in nearly all organs. There was an overall tendency for the mean concentration to increase in many of the organs over time as the fish progressed in ripeness. In prespawning females, IHN virus could be detected in all organs and in ovarian fluid but not in serum; the incidences were highest in the gills, spleen, and pyloric ceca, and the titers were highest in the pyloric ceca and liver. Incidences of infection in the organs were higher in spawning than in prespawning females and higher still in spent females in which the incidence of virus was 100% in all organs except brains (78%) and sera (67%). Virus concentrations in organs or fluids ranged from 5 to 4.0×10^9 plaque-forming units per milllitre. In males, the highest incidences of virus were found in gills, pyloric ceca, and liver. The gills were the only organ in which the virus concentration in males exceeded that of females. (Authors).

002272.

000090

Munger, G. J.

1983. The occurrence of *Anisakis* sp. type I larvae (Oshima 1972) (Nematoda: Anisakidae) in fishes from the Gulf of Alaska and the Bering Sea. Can. J. Zool. 61(1):266-268. (Dep. Zool. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

Of 33 species of fish examined for *Anisakis* larvae, 12 (36%) were infected. Larvae were identified as *Anisakis* type I larvae (Oshima 1972) and were found in fish from all localities surveyed. The small size and feeding habits of some infected fish suggests that small fishes or very small invertebrates rather than euphausids may be the intermediate hosts for *Anisakis* type I larvae. (Author).

002330.

000091

Musselius, V. A.

1981. Gill necrosis of carp. Pages 449-460 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (All Union Sci. Res. Inst. Pond Fish. Rybnoe, Dmitrov District, Moscow Region 141821 USSR.).

Gill necrosis is a mass disease of carp. Its etiology has not yet been revealed. It is suggested that two forms of the disease exist: the viral and noncontagious. The cause of noncontagious form is an ammonia accumulation in the pond water as a result of pond overloading with organic substances.

The disease is spread in many countries among carps of every age group. Outbreaks occur mostly in summer, more seldom in early spring. Clinical symptoms of both forms are similar; no specific changes, typical of the disease, were revealed in hematological, histomorphological, biochemical, and other studies. The diagnosis is made on the basis of a number of laboratory studies, clinical and epizootiological data taken into account. Prophylactic and therapeutic measures against gill necrosis are being taken with the aid of chlorine and burnt lime and calcium hypochlorite, due to which losses in fish production can be considerably cut and a significant economic effect achieved. (Author). (Paper in Russian).

002397.

000092

Nakai, T., Muroga, K.

1982. *Pseudomonas anguilliseptica* isolated from European eels (*Anguilla anguilla*) in Scotland. Fish Pathol. 17(2):147-150. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama, 720, Japan.).

In 1981, the red spot disease occurred in European eels (*Anguilla anguilla*) in Scotland, and this seems to be the first record of the disease in Europe. Then two strains isolated by D. J. Stewart in Scotland were compared with Japanese representative strains of *Pseudomonas anguilliseptica*. According to the results of biochemical characterization tests, agglutinin reactions, precipitin reactions, and pathogenicity tests for Japanese eels (*A. japonica*) and European eels, the Scottish strains proved identical to strain no. 2, the representative strain of K antigen-lacking type (K-type) of *P. anguilliseptica*. (Authors). (Paper in Japanese).

002346.

000093

Nakajima, K., Muroga, K., Hancock, R. E. W.

1983. Comparison of fatty acid, protein, and serological properties distinguishing outer membranes of *Pseudomonas anguilliseptica* strains from those of fish pathogens and other pseudomonads. Int. J. Syst. Bacteriol. 33(1):1-8.

(Dep. Microbiol. Univ. British Columbia, Vancouver, B.C. Canada V6T 1W5.).

Whole-cell fatty acid analyses of 79 *Pseudomonas anguilliseptica* strains demonstrated that all 79 strains were closely related and were distinct from other pseudomonads whose fatty acid profiles were reported previously. Outer membranes were isolated from seven representative strains, and the protein patterns were compared by sodium dodecyl sulfate polyacrylamide gel electrophoresis. Four major outer membrane proteins were found in each of the *P. anguilliseptica* strains but not in the outer membranes of eight other *Pseudomonas* strains or 10 other fish pathogens. The outer membranes of the seven *P. anguilliseptica* strains studied were immunologically cross-reactive. We suggest that outer membrane protein patterns may be a useful taxonomic tool. (Authors).

002345.

000094

Nelson, J. A.

1982. Physiological observations on developing rainbow trout, *Salmo gairdneri* (Richardson), exposed to low pH and varied calcium ion concentrations. J. Fish Biol. 20(3):359-372. (Dep. Zool. Univ. Washington, NJ-15 Seattle, Washington 98195.).

The extinction of piscine populations in waters acidified by atmospheric fallout of pollutants and runoff from coal strip mines usually occurs through recruitment failure. To determine mechanisms of recruitment failure, several physiological parameters of developing rainbow trout were monitored while fish were exposed to conditions of low pH and varied calcium ion concentrations. Cardiac rate, ossification, growth, tissue calcium concentrations, protein maturation, hatching, and mortality were examined. Results indicate a decreased cardiac rate, decreased rate of ossification, slower growth, less pigmentation, delayed hatching and increased mortality under conditions of low pH. Cardiac rate, hatching and mortality varied with the external calcium concentration. (Author).

002296.

000095

Nomura, S., Saito, H.

1982. Production of the extracellular hemolytic toxin by an isolated strain of *Aeromonas salmonicida*. Bull. Jpn. Soc. Sci. Fish. 48(11):1589-1597. (Sch. Fish. Sci. Kitasato Univ. Sanriku, Kesen, Iwate 022-01, Japan.).

Several pathogenic bacteria isolated from furunculosis infected rainbow trouts *Salmo gairdnerii* were identified with *Aeromonas salmonicida*. The organism has been shown to produce relatively large quantities of hemolytic toxin in its culture medium under aerobic condition. The toxin in the supernatant fluid was cytolytic for erythrocytes of sheep and freshwater salmonids in vitro, and the erythrocytes of Japanese common char *Salvelinus leucomaenis* were the most sensitive, among freshwater salmonids, to the toxin. The production of hemolytic toxin was stimulated by the addition of enzymatic hydrolyzates of protein as nitrogen and carbon sources, however it was suppressed with glucose or sucrose. Bivalent metal ions (calcium, cobalt, and manganese) and phosphate ion were also required for both growth and toxin production. The optimum pH range for toxin production was from 7.5 to 8.0, and the optimum temperature was around 20°C. The toxin production occurred during the stationary phase of growth. The hemolytic toxin in the supernatant fluid was rapidly inactivated at 60°C, and is most stable at pH 8.0. These results indicate that the hemolytic toxin is a thermolabile exotoxin, and some kinds of amino acids, bivalent metal ions and phosphate ion play an important role in hemolytic toxin production of the organism. (Authors).

002336.

000096

Oida. T., Kouno, K.. Katae, H., Nakamura, S., Sekine, Y., Hashimoto, M.

1982. Levels of piromidic acid and its metabolites in eel tissues. Bull. Jpn. Soc. Sci. Fish. 48(11):1599-1608. (Res. Lab. Dainippon Pharm. Co. Ltd. Osaka 564, Japan.).

Piromidic acid (PA) and its metabolites (2-OHPA and 3-OHPA) were determined after oral administration by HPLC. After single administration of 40 mg/kg of PA, the drug and metabolites were found in plasma, liver, kidney, spleen, and muscle. The concentration of PA in tissues reached peak levels of 12-18 μg/mL or g 3-6 h after dosing, followed by a gradual decrease. Whereas the concentration of the metabolites reached peak levels 6-24 h after dosing, followed by a relatively slow decrease. Total levels of PA and metabolites in kidney and liver were one and a half times as high as the level in plasma, while the level in muscle was one-half of that in plasma. After 7-consecutive dosing of 40 mg/kg per day of PA, the concentration of the drug and metabolites reached peak levels,

mostly 6 h after final dosing and total levels went below the assay limit within 11 days. In the case of the treatment of fish diseases with PA, PA and the metabolites would be eliminated from tissues within 6 days after single administration or 11 days after 7-consecutive administration. (Authors). (Paper in Japanese).

002339.

000097

Osadchaya, E. F.

1981. Fish diseases, caused by rhabdovirus in Ukrainian SSR. Pages 36-47 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Ukranian Sci. Res. Inst. Fish. USSR G. Kiev-164, Obuch ovskaya 135, Hungary.).

In Ukraine there are two fish diseases that are caused by rhabdoviruses--these are SVC and RHS (Ed. note: RHS = rhabodvirus hepatitis salmonidae). These viruses were isolated from diseased fishes, their important properties studied and their pathogenicity for other fishes was determined. Methods have been worked out for control and prevention. (Author). (Paper in Russian).

002363.

000098

Plumb, J. A.

1981. Relationship of water quality and infectious diseases in cultured channel catfish. Pages 290-303 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Southeastern Coop Fish Dis. Project, Dep. Fish. Allied Aquacult. Alabama Agric. Exp. Stn. Auburn Univ. Ala. 36849.).

Channel catfish (*Ictalurus punctatus*) is the most extensively cultured food fish in the United States. During the past decade an increase in intensity of catfish culture methods has led to a reduction in water quality that increases stress on the fish and makes them more susceptible to disease. Some of the primary water quality characteristics that influence disease susceptibility are high CO_2, NH_3, nitrite, and low O_2. Although each of these factors is individually stressful to the fish they reduce disease resistance more significantly in combination. An example of a case involving an O_2 depletion as result of an algal die-off, followed by an *Aeromonas hydrophila* infection, is described. The relationship of water temperature and alkalinity on disease susceptibility is also discussed. Polyculture utilizing silver carp, tilapia, and grass carp as herbivors in combination with channel catfish to help improve water quality is discussed. (Author).

002384.

000099

Plumb, J. A., Sanchez, D. J.

1983. Susceptibility of five species of fish to *Edwardsiella ictaluri*. J. Fish Dis. 6(3):261-266. (Dep. Fish. Allied Aquacult. Alabama Agric. Exp. Stn. Auburn Univ. Ala. 36849.).

Five species of fingerling fish, channel catfish, *Ictalurus punctatus*, tilapia, *Sarotherodon aureus*, golden shiner, *Notemigonus crysoleucas*, largemouth bass, *Micropterus salmoides* and bighead carp, *Aristichthys nobilis*, were tested to determine their susceptibility to the bacterium, *Edwardsiella ictaluri*, at 26°C. Cnannel catfish demonstrated high susceptibility to *E. ictaluri* as 100% of those fish injected with 1.5×10^8 cells died within 10 days. Tilapia demonstrated slight susceptibility to the pathogen while golden shiner, bighead carp and largemouth bass were not susceptible. *Edwardsiella ictaluri* was isolated from a higher percentage of peritoneal cavities, livers and kidneys of channel catfish than of other species. Sequential growth of *E. ictaluri* in the liver of channel catfish is described. (Authors).

002354.

000100

Prosyanaya, V. V.

1981. Some pathogenic bacteria of freshwater fishes. Pages 82-94 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Ukranian Sci. Res. Inst. Fish. 252164 Kiev, Obuchovskaya 135, USSR.).

Bacteria from genus *Aeromonas*, *Pseudomonas*, *Flexibacter*, Flavobacterium associated with the diseases of carp, bream, salmon, pike perch, channel catfish were studied. It is essential to recognize the primary pathogenic role of the bacteria isolated from diseased fish with myxobacteriosis, necro-

sis, rubella of carp and swim bladder inflammation. (Author). (Paper in Russian).

002371.

000101

Prychitko, S. B., Nero, R. W.

1983. Occurrence of the acanthocephalan *Echinorhynchus leidyi* (Van Cleave, 1924) in *Mysis relicta*. Can. J. Zool. 61(2):460-462. (Dep. Zool. Univ. Toronto, Erindale Campus, Mississauga, Ont. Canada L5L 1C6.).

Mysis relicta has been identified as an intermediate host of the acanthocephalan *Echinorhynchus leidyi* (Van Cleave, 1924) Golvan, 1969 in four of eight lakes examined in northwestern Ontario. Parasite prevalence in *Mysis relicta* ranged from less than 1 to 3.6%. Lake trout (*Salvelinus namaycush*) are a common definitive host. (Authors).

002325.

000102

Sakai, D. K.

1980. Evaluation on the health of salmonid fishes by determinating (sic) the spontaneous hemolysis activity of sera. Sci. Rep. Hokkaido Fish Hatch. 35:73-82. (Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku Sapporo, Hokkaido, Japan.).

Hemolytic activity against heterologous red blood cells and independent of complement occurs in fish sera. The author defines one unit of such spontaneous hemolytic activity as that which will lyse at 30°C 50% of 5 X 10. rtbbrac. goldfish or rainbow trout erythrocytes in 7.5 ml of reaction volume. The activity of sera from several species of fish was determined and changes noted following intraperitoneal injection of *A. salmonicida* or *V. anguillarum*. As an example, in steelhead trout, a normal value of 26 units dropped to 6.6 in fish moribund with a virulent strain whereas the activity did not drop with an avirulent strain. Because the activity changed sharply with physiological conditions and the progress of infectious diseases, hemolytic activity should be regarded as an indicator of fish health. (Ken Wolf). (Paper in Japanese).

002292.

000103

Sato, N., Yamane, N., Kawamura, T.

1982. Systematic *Citrobacter freundii* infection among sunfish *Mola mola* in Matushima Aquarium. Bull. Jpn. Soc. Sci. Fish. 48(11):1551-1557. (Clin. Microbiol. Branch, Central Clin. Lab. Tohoku Univ. Sch. Med. Sendai 980, Japan.).

An epizootic attributable to enterobacteriaceae *Citrobacter freundii* observed among sunfish *Mola mola* in Matsushima Aquarium, Japan. During May to September, 1981, twenty-five out of twenty-nine sunfish died in the aquarium. Almost all the infected sunfish showed the same characteristic pathological changes, that is, hemorrhagic exanthema upheaved from skin surface and multiple lipoid granuloma in the kidney. *Citrobacter freundii* was isolated from the various organs examined. Pure cultures were obtained from kidney granuloma and the spleen, the results indicating that *Citrobacter freundii* was the most likely pathogen. Bacteriological examination of the sea water circulating in the aquarium showed high levels of various enterobacteriaceae, such as *Klebsiella*, *Enterobacter* and *Proteus*, in addition to *Citrobacter freundii*. These findings suggested the urine-water-oral transmission route within the aquarium. Several antibiotics were administered but none were effective in treating the infected sunfish. However, after disinfecting the sea water with chlorine sunfish infection with *Citrobacter freundii* terminated. The unique pathogenecity of *Citrobacter freundii* to sunfish will be discussed regarding host range in sea water. (Authors).

002337.

000104

Schchelkunov, I. S., Shchelkunova, T. I.

1981. Results of virological studies on gill necrosis of carp. Pages 466-482 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (All Union Sci. Res. Inst. Pond Fish. Rybnoe, Dmitrov District, Moscow Region 141821 USSR.).

As a result of virological studies of carps diseased with gill necrosis two viral strains have been isolated. The virions of both strains have a similar structure. Some physico-chemical properties of the virus have been determined, as well as the nature of cytopathic effect in the cell culture and the peculiarities of virus reproduction in the cell. The virus is related to the family of Iridoviridae. The

virus pathogenicity is shown for the carp. In relationship with the virus of carp, gill necrosis is discussed. (Authors). (Paper in Russian).

002399.

000105

Schreckenbach, K.

1981. Immune prevention methods using different polyvalent vaccines of inactivated pathogens against vibriosis of rainbow trout (*Salmo gairdneri*). Pages 134-145 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Inst. Inland Fish. 1162 Berlin-Friedrichshagen, Muggelseedamm 310, German Dem. Rep.).

The effectiveness of polyvalent *Vibrio anguillarum* vaccination of *Salmo gairdneri* in liquid and stomach-resistant formulation by intraperitoneal, hyperosmotic and oral application is compared under experimental conditions. (Author). (Paper in Russian).

002372.

000106

Schubauer, J. P., Scott, C. L., Kowalski, K. T., Spotila, J. R.

1980. Effect of tetracycline hydrochloride treatment on the critical thermal maximum of common shiners. Prog. Fish-Cult. 42(1):48-49. (Savannah River Ecol. Lab. Drawer E, Aiken, S. C. 29801.).

The critical temperature maxima of *Notropis cornutus* in the presence or absence of 4.4 mg per liter of tetracycline hydrochloride were not significantly different. The authors suggest that the antibiotic can be used to control mortality from bacterial infections in closed systems. (Ken Wolf).

002281.

000107

Secombes, C. J., Manning, M. J., Ellis, A. E.

1982. Localization of immune complexes and heat-aggregated immunoglobulin in the carp *Cyprinus carpio* L. Immunology 47(1):101-105. (Dep. Zool, Univ. Hull, Hull, HU6 7RX, England.).

In carp *Cyprinus carpio* L. preimmunized with a protein antigen, human gamma globulin (HGG), rapid localization of antigen occurred in the splenic ellipsoids within 1 day of a secondary immunization given 8 weeks later. Furthermore, after injection of immune complexes or heat-aggregated HGG, antigen was trapped more quickly in the pronephros than when antigen was injected alone. These results support the conclusion that in fish, as in homoiotherms, this form of antigen trapping is antibody-dependent. (Authors).

002301.

000108

Shestakovskaya, E. V.

1981. Diseases of acipenserid fishes during their artificial propagation. Pages 283-289 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Azov Sea Sci. Res. Inst. Fish. 344007, G. Rostov-on-Don, Beregovaya 21/2 USSR.).

Eighteen species of parasites were recorded in sturgeon during the artificial reproduction. At the fish farms of the Azov Sea region the infectious, contagious, and non-contagious diseases were found. The hematological analysis showed quantitative and qualitative changes in the blood of infected fish. The application of the developed complex of measures at the fish farms enabled in many cases to stop fish mortality and improve the condition of cultured fishes. (Author). (Paper in Russian).

002383.

000109

Shinoda, S., Nakahara, N., Ninomiya, Y., Itoh, K., Kane, H.

1983. Serological method for identification of *Vibrio parahemolyticus* from marine samples. Appl. Environ. Microbiol. 45(1):148-152. (Environ. Hyg. Fac. Pharm. Sci. Okayama Univ. Tsushima, Okayama 700, Japan.).

Use of agglutination with antiserum against lateral flagella (H-agglutination) for the identification of *Vibrio parahemolyticus* was studied. Sucrose-negative bacteria were isolated from seawater, and their characterization was carried out by traditional biological tests and slide agglutination with antiserum specific to lateral flagella of *V. parahe-*

molyticus. Of 135 strains isolated, 78 were identified as *V. parahemolyticus* by biological tests and were agglutinated with the above serum. Fifty-five strains did not agglutinate with the serum and their biological characteristics were different from those of *V. parahemolyticus*. Two strains also differed from *V. parahemolyticus* in some biological characteristics but agglutinated with the antiserum. All clinically isolated *V. parahemolyticus* strains also agglutinated with the above serum. These results suggest that our serological method is useful for the identification of *V. parahemolyticus*, especially for samples in which there are many organisms related to *V. parahemolyticus*, because many biological tests can be omitted. (Author).

002315.

000110

Snoj, N., Ocvirk, J.

1981. Discovery of *Cystidicola farionis* Fischer in wild brown trout and the patho-anatomical changes caused by them. Pages 253-258 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Edward Kardelja Univ, Ljubljana Biotech. Fac. Dep. Vet. Sci. 61000 Ljubljana, Gerbiceva 60, Yugoslavia.).

Cystidicola farionis is known all over the world especially in wild salmonids, but the pathological changes were recorded only in cultivated rainbow trout (*Salmo gairdneri*).

We found this parasite pathogenic for wild brown trout (*Salmo trutta*). In Yugoslavia we were the first who found this parasite in the swim-bladder of 2- and 3-year-old wild brown trout and first described the patho-anatomical changes. Our conclusions show the possibilityof infestation with *C. farionis* as a parasitosis under favorable conditions. (Authors).

002380.

000111

Sordyl, H., Linke, A., Kreutzmann, H. K., Pieck, W., Arndt, E. M.

1982. Understanding changes in the marginal zone of erythrocytes caused by disturbance of the physiological balance in fish. (Erfassung von Veranderungen der Erythrozytenrandzone als Ausdruck einer Storung des Physiologischen Status beim Fisch.) Z. Binnenfisch. DDR 29(9):273-278. (Sec. Biol. the W.-Pieck, Univ. Rostock, Fed. Rep. Germany.).

Drops of nonheparinized blood are obtained from the caudal region, spread on a microscope slide, fixed by controlled heat, stained with a mixture of dyes, and examined with an oil immersion lens on a phase contrast microscope. Microphotographs show changes caused by prolonged exposure of rainbow trout to sublethal concentrations of ammonia, lead, and water at 8.9 pH as compared with erythroctyes of normal rainbow trout. Easily visible pathologic changes in the periphery of erythrocytes are presented in the photographs. Authors indicate that this is another useful and new hematologic method for evaluation of the health status of trout. (S. F. Snieszko). (Paper in German).

002312.

000112

Sovenyi, J., Petri, I.

1981. Quantitative investigation of natural hemagglutinins to human ABO blood groups in the sera of three freshwater fishes. Pages 439-448 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Vet. Res. Inst. Hungarian Acad. Sci. 1581 Budapest, P.O. Box 18, Hungary.).

Sera of hatchery-reared carp, common bream, pike-perch from lake Balaton were examined for the presence and activity of natural hemagglutinins to human ABO blood groups.

54.5% of the serum samples of carp, 38.7% from the common bream, and 95.6% of pike perch agglutinated at least one red blood cell suspension of the four blood groups.

The average titer values in the three species were low (carp 30.31, bream 9.20, pike perch 20.31). The average titers of sera decreased in the order of O, A, B, AB, blood groups in case of carp; O, B, A, AB blood groups in bream; and this order was B, AB, O, A in pike perch.

Positive correlation was found between the average titer values with different blood groups in carp.

The authors presume that carp and white bream may have been in close connection with some bac-

teria bearing an H-antigen-like molecule. (Authors).

002396.

000113

Strelkov, Y. A., Solomatova, V. P., Kudentsova, R. A.

1981. Some peculiarities of fish diseases in case of pen rearing. Pages 270-282 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (GosNIORKh, 199053, Leningrad Makarova 26, USSR.).

Several diseases occur in the Soviet Union: trichophriosis of trout, ambiphriosis of channel catfish, chilodonellosis of carp, trout and coregonids, diplomostomosis of trout, carp and coregonids, trienaophorosis of salmonids, gyrodactylosis of carp, ergasilosis of coregonids and salmonids, argulosis of young carp, dropsy of carp, swim bladder inflammation of carp, branchiomycosis of carp, and saprolegniosis.

In warm water farms, several protozoan ectoparasites seem to be hindered: those which can propagate quickly and cause disease in ponds. Some parasites, (*Triaenophorus nodulosus, T. crassus*) increase greatly in number becoming a source of disease. Depth of water below the pens has great significance. In case of low depth, organic matter and remains of food collect rapidly and result in toxic compounds. Overcrowding, improper food, low or high temperature, often weaken the fish and cause disease. Prevention is based on prophylaxis and suitable site selection. For therapy, medicaments are the same as those used in ponds, but results in pens can be different. Research is needed. (Authors). (Paper in Russian).

002382.

000114

Studnicka, M., Siwicki, A.

1981. Ultrastructural changes in the gill and liver of *Cyprinus carpio* exposed to Lindane. Pages 506-513 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Sci. Res. Inst. Fish Cult. Zabieniec, Warsaw, 05-500 Poland.).

Lindane is frequently used in agriculture being an important ingredient of several plant protecting chemicals due to its low toxicity. It is well known, however, that the chlorinated hydrocarbons can be toxic when they accumulate in the organism. For the time being, there are very few data dealing with the ultrastructural damage of animal organism toxicated by Lindane. Our own investigations proved the high toxicity of this chemical for fishes exposed to Lindane solution of different concentrations which caused histological damages in gill and liver tissues. The aim of our work was to determine the toxicity of Lindane for carp on the basis of ultrastructural change of gill and liver. (Authors). (Paper in Russian).

002402.

000115

Svobodova, Z., Geitmanek, M., Gavlikova, Y.

1981. Fishes as indicators of mercury contamination of water. Pages 393-402 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Sci. Rec. Inst. Fish. Hydrobiol. 38925 Vodnany, Czechoslovakia.).

In the past 10 years eminent attention was focused on mercury compounds. During the studies on mercury content of the Berounka River basin the fishes, sediments, water, aquatic plants, and invertebrates were analyzed. Fishes are the most important indicators of mercury contamination, the average Hg content in muscle was 0.1-0.77 mg. kg^{-1}. Leeches are also important indicators. The highest Hg content was found in fishes even from pond biocenosis with different character of catchment area. The upper limit, 0.1 mg. kg^{-1} of Hg concentration in fish muscle was not exceeded. Mercury content was low in ponds of different catchment area, though differences among individual ponds were not significant. In experiments with a diet contaminated with Hg, high accumulations were found in the fish body, particularly kidneys. Tissue levels were stable and no decreases were found during the following 18 months. Feeds contaminated with Hg must not be fed to fish. (Authors). (Paper in Russian).

002392.

000116

Svobodova, Z., Groch, L., Faina, A. R.

1982. The effect of long-continued bath in methylene blue on young carp. (Vlv dlouhodobe koupele v metylenove modri na pludek kapra.) Bull. VURH Vodnany 18(1):35-38. (Vyzkumny Ustav Rybarsky a Hydrobiologicky, 389 25 Vodnany, Czechoslovakia.).

Long-term methylene blue bath (200 mg per liter for 7 days) was studied as to its effect on young carp. The evaluation and comparison between the test and control groups of fish comprised the survival rate of the fish, the pathoanatomic and histopathological picture, parasitic, bacteriological and hemolytical examination. Although the parasitological finding in the fish treated with long-term methylene blue bath was negative in all cases except diplostomosis, the use of this bath cannot be recommended. Mortality and the pathoanatomic, histopathological and hematological changes in the carp treated with methylene blue bath testify to its toxicity. (Authors). (Paper in Czech.).

002282.

000117

Svobodova, Z., Havlikova, J., Piskach, A., Groch, L.

1981. Effect of feed with content of aflatoxin B_1 on the health condition of carp. Pages 380-391 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Sci. Res. Inst. Fish. Hydrobiol. 38925 Vodnany, Czechoslovakia.).

Experiments indicated that the presence of aflatoxin B_1 at a dose 2 μg per kg of feed, administered during the whole vegetation period, did not influence the weight, condition, health, and physiological state of carp C_{1-2} nor did it leave any aflatoxin residues in the muscles. Doses of 20 and 200 μg of aflatoxin B_1 per kg of feed, administered during the whole vegetation period, had no effect on weight, condition and physiological state, and on pathoanatomic and parasitic findings of carp (C_{1-2}, C_{2-3}). Histopatholgical picture of experimental fish was characterized by circulation disorders in parenchymal organs and gills. A serious dystrophic change of nerve cells, dystrophy of liver tissue, and damage to kidneys were observed in carp fed with 200 μg of aflatoxin B_1 per kg of feed. Residues of aflatoxin B_1 in this group of fish were as follows: hepatopancreas - 17.6 $\mu g. kg^{-1}$ of fresh tissues, muscles - 2.96 $\mu g. kg^{-1}$ of fresh tissue. (Authors). (Paper in Russian).

002391.

000118

Takahashi, K., Arima, T., Mori, M.

1982. Studies on ulcer disease of goldfish - VI. Effects of water temperature. Fish Pathol. 16(4):173-179. (Tech. Off. Tokyo Metropolitan Fish. Exp. Stn. Katsushika-ku, Tokyo, Japan.).

The epidemic of ulcer disease of goldfish is in the spring. The condition is first observed in April and the diseased fish increase in number until June or July. Water temperature plays an important role in the etiology of this disease. In the present study, two experiments were performed. In experiment one, infection was artificially induced at water temperatures from 2.5 to 30°C. The lesions could be induced within the range of temperture from 7.5 to 30°C. The terminal stage of the lesion was obeserved after 5 days at 25-27.5°C and 14 days at 12.5°C, respectively. In experiment two, diseased fish collected from culture ponds were kept in tanks with water at temperatures from 20 to 30°C. The rapid recovery of lesions was observed at temperatures above 27.5°C. From these results, it is conceivable that the harmful temperature for the ulcer disease of goldfish is about 18 to 23°C. (Authors). (Paper in Japanese).

002290.

000119

Taniguchi, M.

1982. Studies on the streptococcicosis of yellowtail and its preventions in Kochi Prefecture. Fish Pathol. 17(1)55-59. (Kochi Pref. Freshw. Fish. Lab. Tosayamada, Kochi, Japan.).

The species of fish used as feed and the methods of handling are considered important in occurrence of the disease. It was assumed that yellowtail are infected orally by contaminated feed. To prevent the problem it was proposed that feed fish be thawed in clean water, or that frozen fish be fed without thawing, or that pelleted rations be used. Feed fish quality that had deterioriated and gave imbalanced nutrition lowered yellowtail resistance to disease. That situation changed when unthawed feed was given and supplemented with a vitamin mixture. Organic pollution of the water is deleterious and should be prevented. Streptococcosis is difficult to treat, therefore preventive meas-

ures are important. If those fail, early detection and diagnosis are important. (Ken Wolf). (Paper in Japanese).

002278.

000120

Taniguchi, M.

1982. Influence of food condition on artificial peroral infection of yellowtail streptococcicosis. Bull. Jpn. Soc. Sci. Fish. 48(12):1721-1723. (Kochi Pref. Freshw. Fish. Lab. Tosayamada, Kochi 782, Japan.).

Influence of food condition used for application of pathogen on the appearance of streptoccicosis were examined by the peroral inoculation test for yellowtail. The incidence of the disease in the test were remarkably different depending on the food condition given to yellowtail, such as the form of food (whole, chopped, and pellets) and the state of food (raw, frozen, and thawed). The incidence was very high in the case of chopped food, and no disease occurred in the case of whole food, when sand launce (large size) and sardine were used for food species. The disease did not occur either in the case of pellets. The incidence of the disease was higher in the case of thawed food than in the case of frozen food. It was suggested that the thawed food accelerates the appearance of the streptococcicosis. (Author). (Paper in Japanese).

002332.

000121

Taniguchi, M.

1982. Experiment on peroral inoculation via food to induce yellowtail streptococcicosis. Bull. Jpn. Soc. Sci. Fish. 48(12):1717-1720. (Kochi Pref. Freshw. Fish. Lab. Tosayamada, Kochi 782, Japan.).

In this study it was examined how to reproduce the typical symptoms by the peroral inoculation method through food. The typical symptoms of the disease observed in the peroral inoculation tests were as follows: opthalmitis with bloody pus, redness at eyeball; melting of branchiostegal membrane, caseous pus and redness at inside of operculum; caseous pus at basal part of fins and caudal peduncle; bloody pus, redness at the part between palatine and vomer; redness of arterial bulb, thickening of epicardium and adhesive epicarditis; thickening of serosa, congestion and bleeding at liver. These symptoms appeared within 2 weeks after dosing the pathogen, when the pathogen was mixed into homogenized fish meat or injected under the skin of food fish. The effective number of pathogens dosed was 10^8 cells per individual weighing 300-500 g in the case of mixing pathogen into homogenized fish meat, and 10^9 cells per individual in the case of injecting pathogen under the skin of food fish. (Author). (Paper in Japanese).

002333.

000122

Tesarcik, J., Macura, B., Trtek, J., Flora, M., Sana, B.

1982. Carp vaccination against spring viremia on the fish farms of the state fisheries (II). (Provozni vakcinace kapru proti jarni viremii na zavodech statniho rybarstvi (II).) Bul. Vurh Vodnany 18(1):13-19. (Vyzkumny ustav rybarsky a hydrobiologicky Vodnany, pracoviste Varenska 51, 701 00 Ostrava 1, Czechlov.).

Of the total number of 582,900 carps 2 and 3 years old vaccinated in the autumn of 1979 and for the most part in the spring of 1980, 44,413 market carps were caught in the autumn of 1980 (i. e. 76.75% of the released vaccinated carps). (Authors). (Paper in Czech.).

002295.

000123

Toranzo, A. E., Barja, J. L., Potter, S. A., Colwell, R. R., Hetrick, F. M., Crosa, J. H.

1983. Molecular factors associated with virulence of marine vibrios isolated from striped bass in Chesapeake Bay. Infect. Immun. 39(3):1220-1227. (Dep. Microbiol. Univ. Maryland, College Park, Md. 20742.).

On the basis of cultural and biochemical properties as well as DNA homology assays, 81 *Vibrio* strains isolated from diseased striped bass and from Chesapeake Bay water were assigned to eight distinct groups. All organisms belonging to two of the groups were pathogenic for striped bass and were identified as *Vibrio anguillarum*, whereas organisms classified in the other six groups were nonpathogenic and were designated as *Vibrio* spp. Unlike the pathogenic *V. anguillarum* strain 775 isolated in the Pacific Northwest, strains pathogenic for striped bass did not contain any plasmids; however, they were similar to the Northwest isolates in that virulence was correlated with their ability to grow in the presence of nonimmune striped bass serum or under conditions of iron lim-

itation. Sodium dodecyl sulfate polyacrylamide gel electrophoretic analysis of outer membranes showed that additional proteins were induced in those organisms capable of growth under conditions of iron limitation. It was of interest that 22 of the nonpathogenic isolates harbored one or more plasmids which, by restriction endonuclease analyses, were shown to be clearly different from the virulence plasmid pJM1. (Authors).

002317.

000124

Verbickaya, I. N.

1981. Organization and tasks of Ichthyopathological Service of Ministry of Fisheries in the USSR. Pages 514-517 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Cent. Ichthyopathol. Inspection Serv. Minist. Fish. USSR, Moscow, Rozhdestvenskii, Boulevard 12, USSR.).

Ichthyopathological Service of the USSR Ministry of Fisheries founded in 1974 is responsible to study sanitary and epizootic conditions of fish breeding and cultivating reservoirs; to develop and implement counter epizootic arrangements to create favorable conditions; to bring the achievements of science into the practice of fish culturing; to arrange and conduct the improvement of qualification of specialists in the field of prevention and treatment of fish diseases. There are specialists employed in the Ichthyopathological Service of the Ministry – ichthyopathologist in the laboratories, industrial fish farms, and in special ichthyopathological stations. The Service is headed by the Central Ichthyopathological Inspection of the USSR Ministry of Fisheries. (Author). (Paper in Russian).

002403.

000125

Vichman, A. A.

1981. Quantitative determination of some humoral factors of immunity in organs and tissues of common carp. Pages 425-438 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (VNPO Fish. Rybnoe 141821, Moscow Oblast, USSR.).

The paper describes improved methods for quantitative determination of lysozyme and natural hemagglutinins in tissues of carp. Sample treatment included measurement of initial volume of the material, measured introduction of the extracting liquid and measurement of the obtained extract volume. Absolute and relative lysozyme and hemagglutinin content have been determined in lymphoid organs. Irregular distribution has been established of the factors studied in carp immunity system, as well as differences in various factor distribution. (Author). (Paper in Russian).

002395.

000126

Weirowski, F.

1982. Diagnostic procedures used in the fish health service of carp and trout. (Das Diagnotische Uberwachungsprogramm des Fischgesundheitsdienstes fur Karpfen and Forellen.) Z. Binnenfisch. DDR 29(9):278-284. (Central Off. Fish Health Serv. Berlin, German Dem. Rep.).

Fish health service in Eastern Germany (German Democratic Republic) is based on routine and frequent examination of carp and trout in order to establish the health conditions existing in various fish cultural establishments. The following procedures are included in routine examinations: gross examination of fish, parasitology, hematology (seven parameters), serum ammonia, histology, bacteriology, and virology, chemical examination of water, and the availability of natural food. (S. F. Snieszko). (Paper in German).

002313.

000127

Weirowski, F.

1981. Some points concerning the relevance of *Bothriocephalus acheilognathi* to freshwater fishery in the German Democratic Republic. Pages 243-252 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hunary. 23-27 Jun. (Fish Health Serv. GDR, 1162 Berlin, Muggelseedamm 310, German Dem. Rep.).

The Fish Health Service of the GDR analyzed the epizootiology of Bothriocephalosis. Tests revealed Bothriocephalosis in 220 carp farms, these account for 13% of the pond area of the GDR. In

the last 5 years the average extent of infestation was 14.5% of the fish stocks affected. The intensity of infestation reached an average of 2.6 tapeworms per fish. Under our climatic conditions it has spread only slowly and host-parasite relationship has levelled off from which relatively constant rates resulted. Carp production is endangered only if stocks are heavily infested. The Bothriocephalosis has only little economic relevance if government injunctions are effectively coordinated with measures of prophylaxis, active therapy and permanent veterinary control of fish stocks. (Author).

002379.

000128

Winton, J. R., Lannan, C. N., Fryer, J. L., Kimura, T.

1980. Isolation and characterization of a new reovirus from chum salmon. Pages 359-367 *in* Proceedings of the North Pacific Aquaculture Symposium, Anchorage, Alaska, 18-21 August 1980; Newport, Oregon, 25-27 Augus. (Dep. Microbiol. Ore. State Univ. Corvallia, Ore. 97330.).

This report describes the isolation of a new virus from adult chum salmon (*Oncorhynchus keta*). The agent was isolated in the CHSE-214 cell line derived from chinook salmon (*Oncorhynchus tschawytscha*) during a required inspection prior to the importation of chum salmon eggs from Japan into the United States. This virus replicates in selected fish cell lines between 10 and 20°C causing a unique cytopathic effect. Physical and chemical studies have shown the virus to be a member of the family Reoviridae and distinct from any known virus of fish. Electron microscopy of negatively stained particles reveals an icosahedral virion approximately 75 nm in diameter composed of a double capsid. Treatment with *a*-chymotrypsin removed the outer capsid yielding a subviral particle with enhanced infectivity. The virus is chloroform stable indicating the absence of essential lipids. It is resistant to pH 3, and is inactivated at 56°C. Viral replication is not inhibited by 5-fluro-2'deoxyuridine suggesting an RNA genome and acridine orange stain reveals typical reovirus-like cytoplasmic inclusions. The virus replicates in chum, chinook and kokanee salmon (*Oncorhynchus nerka*) fry and causes focal necrosis in the liver of chum and chinook. No mortality was observed in these three species tested. (Authors).

002362.

000129

Wolf, K.

1983. Biology and properties of fish and reptilian herpesviruses. Pages 319-366 *in* B. Roizman, ed. The herpesviruses, Vol. 2. Plenum Press, New York and London. (U. S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

This review chapter covers the six herpesviruses that were recognized at the time of writing (early in 1981) – *Oncorhynchus masou* virus, *Herpesvirus salmonis*, carp pox virus, channel catfish virus, turbot herpesvirus and walleye herpesvirus. At least three additional fish herpesviruses have since been recognized. Seven genera of reptiles are hosts to six or possibly eight herpesviruses – isolations and serologic determinations can resolve the actual number – and those agents are similarly discussed. The chapter includes 36 figures and 51 references. (Author).

002309.

000130

Wolf, K., Markiw, M. E.

1981. Salmonid whirling disease: new findings indicate that the infective stage produced in and released by tubificid oligochaete is a Triactionmyxon. Fish Health News 10(4):ii-iv. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Box 700, Kearneysville, W. Va. 25430.).

Tubificid oligochaetes, which bore infectivity for whirling disease, harbored an organism of the genus Triactionmyxon, and that sporozoan gave a positive reaction in direct FAT with anti-*Myxosoma cerebralis* serum. Triactinomyxons were found only in populations of tubificids that had been kept in contact with *M. cerebralis* spores for 3 to 4 months. Mature Triactinomyxons were first found about 3.5 months after *M. cerebralis* spores were placed with the tubificids. Soon after, the Triactionmyxons were also waterborne, and it became possible to harvest them by differential screening. Triactionmyxons were selectively concentrated on 50 µm screen where earlier work showed peak infectivity of whirling disease was trapped. Experimental transmission of the Triactinomyxon is in progress. (Authors).

002304.

000131

Yunchis, O. N.

1981. Factors promoting myxosporean infection in fish. Pages 304-321 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (GosNIORKh 199053 Leningrad, Makarova 26 USSR.).

The presence of invasive myxosporidian spores in waters does not always result in the infestation of the host organism.

The infestation of fish with Myxosporidium species depends on the structure and food-defined character of the digestive tract as well as on the age of fish and on the season. (Author). (Paper in Russian).

002385.

000132

Zale, A. V., Neeves, R. J.

1982. Identification of a host fish for *Alasmidonta minor* (Mollusca: Unionidae). Am. Midl. Nat. 107(2):386-388. (Virginia Coop. Fish. Res. Unit. Dep. Fish. Wildl. Sci. Virginia Polytechnic Inst. and State Univ. Blacksburg, Va. 24061.).

Among 24 species of fish periodically examined for glochidial infections between May 1979 and June 1980 in Big Moccasin Creek, Virginia, the banded sculpin (*Cottus carolinae*) was the only species infected with glochidia of *Alasmidonta minor*. (Authors).

002287.

000133

Zale, A. V., Neves, R. J.

1982. Fish hosts of four species of lampsiline mussels (Mollusca: Unionidae) in Big Moccasin Creek, Virginia. Can. J. Zool. 60(11):2535-2542. (Va. Coop. Fish. Res. Unit, Dep. Fish. Wildl. Sci. Virginia Polytech. Inst. State Univ. Blacksburg, Va. 24061.).

Collections of stream drift and fishes were made weekly from May to November 1979 and twice monthly from December 1979 to June 1980 to define the periods when glochidia of four mussel species (subfamily Lampsilinae) were in the drift or attached to host fishes. Representatives of all families and most genera of fishes in the stream, including all naturally infected species, were artificially exposed in the laboratory to glochidia of the four species to enable positive identification of host species. The lampsiline mussels displayed a high degree of host specificity. The host fishes were as follows: *Villosa nebulosa*, smallmouth bass (*Micropterus dolomieui*), and rock bass (*Ambloplites rupestris*); *Villosa vanuxemi*, banded sculpin (*Cottus carolinae*); *Medionidus conradicus*, redline darter (*Etheostoma rufilineatum*), and fantail darter (*E. flabellare*); and *Lampsilis fasciola*, smallmouth bass. Periods of natural infestation on fishes corresponded with the occurrence of glochidia in the drift and were different for each mussel species. Duration of the period of attachment on host fishes in the laboratory depended on mussel species, water temperature, and the time when glochidia were obtained from gravid female mussels. (Authors).

002342.

000134

Zanin, E., Allegretti, M., Giorgetti, G., Ceshia, G.

1983. Initiation and appriasal of an official prophylactic policy against VHS in farmed trout in the province of Trento, Italy. Bull. Eur. Assoc. Fish Pathol. 3:5-6. (Inst. Zooprofilattico Sper. Venezie, Udine, Italy.).

In 1978 the Province of Trento investigated a prophylactic scheme to control viral hemorrhagic septicemia (VHS) in farmed trout. This included the disinfection of farms and controlled restocking, even of public waters, with VHS-free fish. Of a total of 71 farms presently in the Province, 50 are included in the regulated area and of these 28 have been disinfected, five of which experienced reinfection. We describe here some of the measures we have taken since 1978 to control VHS and offer an appraisal of the problems and efficacy. (Authors).

002348.

000135

Zaugg, W. S., Roley, D. D., Prentice, E. F., Gores, K. X., Waknitz, F. W.

1983. Increased seawater survival and contribution to the fishery of chinook salmon (*Oncorhynchus tshawytscha*) by supplemental dietary salt. Aquaculture, 32(1,2):183-188. (Natl. Oceanic Atmos. Admin. Natl. Mar. Fish. Serv. Northwest

Alaska Fish. Cent. Coastal Zone and Estuarine Stud. Div. 2725 Montlake Boulevard East, Seattle, Wash. 98112.).

Addition of sodium chloride (NaCl) to the diet of juvenile fall chinook salmon for 6 weeks prior to release resulted in 65% greater adult recovery in the fishery and return to the hatchery than obtained with controls fed an unsupplemented diet. In a separate study, juvenile fall chinook salmon fed supplemental sodium chloride had significantly higher gill sodium and potassium (Na^+-K^+) ATPase activities and greater survival than controls when transferred directly to seawater net-pens. (Authors).

002326.

000136

Zitnan, R.

1981. New helminthoses of the carp in the Carpathian region of Czechoslovakia. Pages 222-242 *in* J. Olah, K. Molnar, and Z. Jeney, eds. Proceedings of an International Seminar on Fish, Pathogens and Environment in European Polyculture, Szarvas, Hungary. 23-27 Jun. (Helminthol. Inst. Slovak Acad. Sci. Kosice, Czechoslovakia.).

The objective of the work was to study the distribution (1976-1977) and to elucidate the outset and formation of first invasions (1978-1979) induced by new agents, *Gyrodactylus schulmani* and *Bothriocephalus gowkongensis* in carp fry. *Gyrodactylus schulmani* is distributed in 26 localities and its invasion cycle is dynamic. The mean values of extensity and intensity of invasion increase gradually from the first invasions of carp fry, reach their maximum in summer, and then decrease in the autumn. In winter only sporadic parasites were recorded.

Bothriocephalus gowkongensis is distributed in 10 localities and its invasion cycle is also dynamic. The mean vaues of extensity and intensity of invasion increase gradually from the first invasions of the carp fry until the first half of August when they reach their maximum. The invasion of fish decreases until the end of the vegetation period. Following the transfer of fish for wintering, extensity and intensity of invasion do not decrease markedly, and during winter no destrobilization occurs. (Author).

002378.

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THE DEPARTMENT OF THE INTERIOR

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